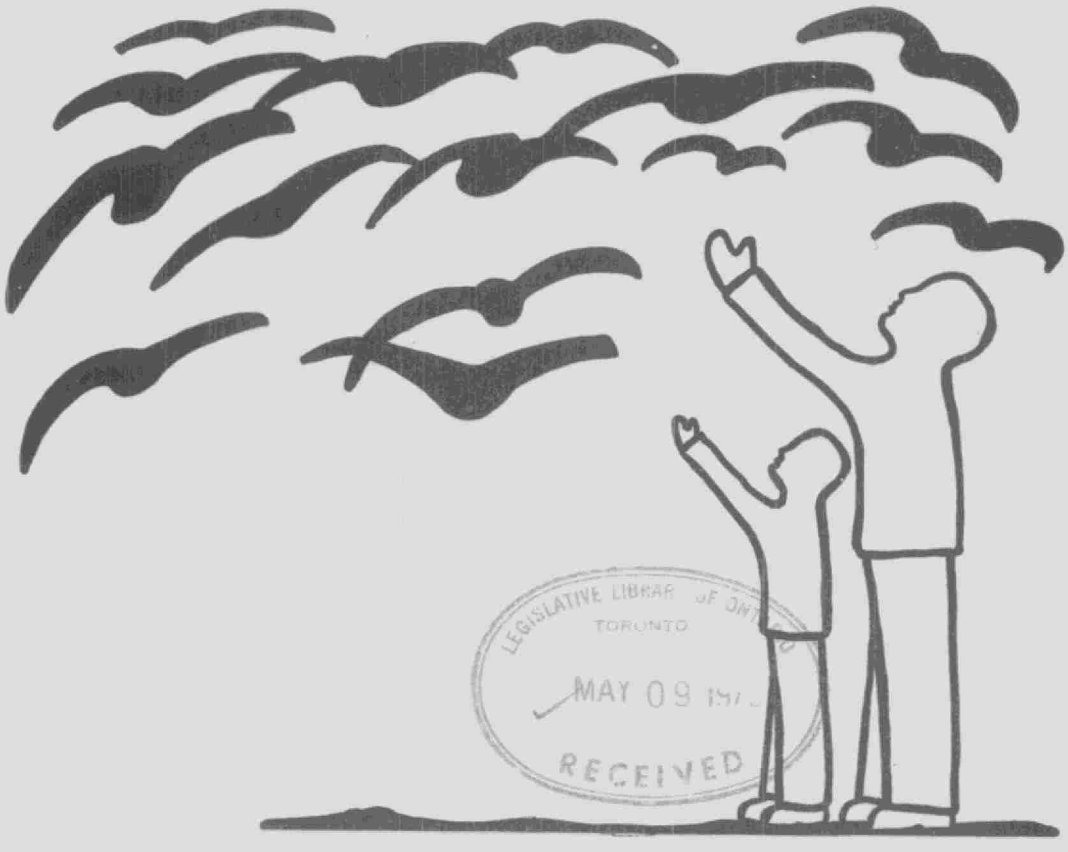
Introducing Your Child to Nature



Ontario
Ministry of the Environment
Hon. Harry C. Parrott, D.D.S., Minister
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INTRODUCING YOUR CHILD

TO NATURE

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The Ontario Ministry of the Environment is responsible for the protection of the air, water, and land of this Province.

Most of the pollution problems we have today are caused by man in his never-ending search and desire for an easier lifestyle.

Although we can't get rid of all sources of pollution -- this would mean no heat, electricity, running water, manufactured goods, little food, etc. -- we can reduce what we do have to a manageable amount. This calls, however, not only for government action, but also for assistance from the private citizen in cutting back on his demand and use of products that pollute either after purchase, such as cars, or during the manufacturing process (aluminum goods), or for products that exhaust our valuable renewable or non-renewable resources.

This book was designed by Ministry of the Environment staff to develop among its readers an appreciation of nature and an awareness of the sensitivity and delicate balance of the various components of our environment. Hopefully, it will encourage the citizens of Ontario to develop their own personal environmental ethic to assist us in the never-ending fight against pollution.

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Introduction

I TOOK HIS HAND AND FOLLOWED

My dishes went unwashed today,
I didn't make the bed,
I took his hand and followed
Where his eager footsteps led.

Oh yes, we went adventuring,
My little son and I...
Exploring all the great outdoors
Beneath the summer sky.

We waded in a crystal stream,
We wandered through a wood...
My kitchen wasn't swept today
But life was gay and good.

We found a cool, sun-dappled glade
And now my small son knows
How Mother Bunny hides her nest,
Where jack-in the-pulpit grows.

We watched a robin feed her young,
We climbed a sunlit hill...
Saw cloud-sheep scamper through the sky,
We plucked a daffodil.

That my house was neglected,
That I didn't brush the stairs,
In twenty years, no one on earth
Will know, or even care.

But that I've helped my little boy
To noble manhood grow,
In twenty years, the whole wide world
May look and see and know.

- Author Unknown

WHY BOTHER WITH NATURELORE?

"All art, all education, can be merely
a supplement to nature"
- Aristotle

The world about us is an exciting place crammed with tiny miracles.

Miracles? Too strong a word, perhaps, but what else can you call the appearance of tiny leaves on tree branches that only yesterday seemed dry, lifeless pieces of wood? What word can you coin to describe the transformation of a fuzzy, plodding caterpillar into a beautiful, graceful flying creature? How do those ugly, slimy, wriggling worms turn your garden into the ideal spot for brightly-hued jewels of flowers?

Yes, we could just label it as nature's way and leave it at that. But isn't that robbing ourselves of some of the splendor of life?

All around us we have bits of magic unfolding and yet we tend to overlook them in our hurry to pick up the groceries, drive the kids to their music lessons, or to walk fast enough to wear off last night's calories. It's like missing the most exciting moments of a hockey game or the climax of a play because you were out getting popcorn.

There's also another reason for learning to appreciate nature -- serenity -- a feeling of peace and contentment.

Serenity comes from knowing that we belong to something greater than ourselves; from understanding that each of us has a role to play in the overall scheme of life; and from realizing that we fit into an eventful pattern of miraculous happenings.

Will it benefit my child?

Children are natural explorers. Perhaps, it is because they are closer to the ground. Left on their own, young children often stop and study with great interest a busy ant or a hard-working spider -- often interfering in the creature's busy life. However, as they get older, their parents or teachers ingrain upon them an increased emphasis on haste and the child's enthusiasm and eagerness to understand the world about him is channeled into more concrete, immediate, reward-oriented activities, such as bringing home a good report or a trophy for swimming.

In itself, this type of lifestyle is not a harmful one. Among other things, it helps to develop self-discipline, initiative and drive. However, it does tend to slightly alienate the child from his family.

The parent can drive the child to his swim or hockey lesson but in most cases he must observe, unspeaking, from the sidelines. He can help his child with homework but he can't sit beside his offspring at school.

This is where an interest in nature comes in. Nothing can take the place of family participation in nature outings and activities. Many families have found that in sharing the wonders of nature with each other, new doors of communication into other areas of their life have opened. How can a child, who has learned

through nature walks with her mother that her thoughts and feelings won't be laughed at, have any fears at voicing a personal problem?

Michael Landon, actor and producer of the popular TV show "Little House on the Prairies", once said that he felt that there were fewer adolescent problems in the days of the early settlers because families by necessity had to work and live closely together and because learning, understanding, and working with nature's signs and gifts meant survival and the so-called extras in life (i.e. dyes for material, seasonings for food).

If we do get involved in nature activities, will it help my child in school?

While observing and talking about nature with you, your child can accomplish the following:

(1) increase his language and motor development;
(2) advance basic concepts pertaining to plant and animal life;
(3) strengthen his senses;
(4) learn to preserve our natural resources through thoughtful care and management; and
(5) develop hobbies which will offer a constructive use of his leisure time.

Won't my child accomplish these things in the regular classroom setting?

Most likely, he will. But nature's classroom provides opportunities to add true meaning and understanding to the thinking, reading, and computing skills in the classroom. Nature provides opportunities to apply the principles of science, mathematics, physics, ecology, and conservation to the real world.

For example, a teacher once asked a geologist to come to her Grade 6 classroom and discuss his work.

The geologist decided to begin his talk with a question: "If you dig a deep hole into the earth, would you find the area getting hotter or colder?"

No one answered.

He repeated the question. Everyone looked puzzled.

Finally, the teacher came up to him and suggested that he rephase the question. "Ask them, what is the state of the interior of the earth?", she said.

So he did, and immediately all the hands in the room were waving furiously.

After all, everyone knows the interior of the earth is in a state of igneous fusion!

But I don't know much about nature myself. How can I teach it?

The role of the parents in the activities that we have included in this book is not that of a teacher.

We have provided some "nice to know" information but essentially we are asking the parent to be an obtrusive guide, willing to take the time to sit down with their child and watch an army of ants march by on their way to work or to listen to the sounds different types of snow makes or to observe the moon as it passes through the seasons of the year.

Every child is different so there is no tried and true method of dealing with a child in the out-of-doors.

Our only guideline is that the parent should try to make casual suggestions and ask questions that shift a child's focus from the use of one sense to a multi-sensory response. Instead of asking "What does that animal, branch, or flower look like?", ask "What can you tell me about that animal, branch, or flower?"

Another good approach is to ask "What will happen if...?"

Will I need any identification books?

Obviously, identification guides are useful tools and good to have on hand. However, being able to tell your child the name of a particular tree or insect is not as important as being able to help him discover how that specimen is different or similar to the other objects around it.

A child will rarely remember a species name read to him out of a book but he will remember a type of tree that has soft, rounded needles, smooth bark, and a nice smell.

It can also be fun to look things up together and check out all the points of similarity.

Will we have to go to a forest to conduct the studies included in this book?

A woodland setting is necessary for a few of the nature activities but there are a number of things you can see or do in your backyard. A square foot area on your lawn can yield a wide diversity of plants and animals. Surprisingly, side-walks, bricks, and concrete walks often make good spots for observing.

My child has a very mechanical mind. How can I interest him in nature?

Often children with practical frames of mind enjoy hearing and observing how some of man's inventions are based on natural occurrences in the animal kingdom. Many birds and animals camouflage themselves as do some soldiers' uniforms; wasps were adept at paper-making long before man; bats have their own radar system; and, the flight of birds encouraged man to take to the skies.

Do I have to undertake all the activities in this book?

No. This book is not meant to be a total program. It offers a variety of activities for you to carry out with your family, according to your interests, seasons, and the setting.

In some cases, we have included a series of questions. These are intended only as suggestions and should be used or modified as befits the occasion. We do, however, recommend that you use a casual questioning approach to all explorations rather than a formal, show and tell method.

We have also included some "nice to know" information and vocabulary with some studies. Again, please use at your own discretion.

The length of time spent in an activity is optional. The child should, however, be actively involved in looking, listening, and trying to analyze what he or she is experiencing. If the child loses interest, it is time to move on to something else.

BASIC GENERAL RULES

1. Leave only your footprints behind

Litter destroys the appearance of an area. Always wait to find a garbage can before discarding rubbish.

2. Enjoy. Don't rearrange!

Trampling vegetation, removing logs and stones, and throwing rocks may destroy or disturb the homes of animals.

Stripping bark from a tree will kill it.

3. Disturbance may mean death

Do not disturb birds or other animals, or try to pick up their eggs or young. A frightened animal may desert its offspring, leaving them at the mercy of predators.

4. Take notes and photographs, not specimens

Some collecting may be necessary, but never take more than you actually need and never from an area that appears to have less than one hundred types of that particular species.

Wild plants and animals thrive best in their natural environment.

If you pick up a live specimen, such as an insect, to take a closer look at it or to show it to a friend, return it unharmed to its original setting.

Never dig up wild plants for your garden.

Picking wildflowers prevents them from seeding and may lead to a decline of that species.

5. Take it slow!

Learn to stop, look, and listen to the wonders of the world about us.

Walk Before You Run

LET'S TAKE A WALK

Nature's seasonal offerings can change familiar walks to new and exciting adventures, if only we take the time to observe what is going on around us and to indulge our curiosity.

It is easy to involve children in these types of adventures because they are natural explorers and investigators and enjoy expressing their feelings about the environment. However, they do need to be encouraged to look, listen, taste, touch, and imagine. Opportunities to assist them to become more visually-aware are limitless. Imagination can run riot.

When the unexpected happens on your walk, previous plans must be put aside.

How far aside depends on your child's attention span. Perhaps, he wants to stop and watch a work crew laying pavement, a bird building a nest, or a caterpillar crossing the sidewalk. Perhaps, he wants to talk about the machinery or about similar experiences or other things he has seen. The parent should listen to the discussion and encourage the child to continue his verbalization by asking additional questions. New vocabulary can be introduced.

The following is a suggested list of questions which you and your child might discuss during your walks. But don't stop with these, there are plenty of other avenues to explore!

On A Spring Day

A walk in early spring can become a time for viewing miracles. There are so many new things to observe, so many old friends returning to familiar haunts and so many little buds bursting open with new growth. It is truly a time of rebirth.

Does the air smell different? What sort of things can you smell?

Do you hear any sounds that make you feel angry, sad, beautiful, happy, or tough? Do you hear any sounds that remind you of colors: red, black, orange, green, yellow, or purple?

What colors do you see? Can you see any new flowers forcing their way up through the ground? Can you see new buds on the trees? Where?

Do you see any birds you didn't see during the winter months? Do you see any birds building nests? What materials are they made from? Is the nest put in a special place for protection? How is it comfortable? What will the young birds need? If you were building a nest for yourself, what sort of materials would you use? Where would you put it? Would a real bird use your nest?

Note: Do not disturb a nest even if it is deserted. Some birds will use the same nest year after year.

Look for bugs. Is it true that all bugs look alike? Watch them move and observe what they are doing. Do bugs all move at the same pace? Do you think a bug's sense of time is the same as yours? Think of ten words to describe bugs. Think of five things bugs do better than you do, and five things you do better than they do.

On A Summer Day

Sunlight adds a large measure of beauty to the outdoors. Watch the long shapes which sunlight creates in the trees or the field. Do the leaves seem to be a different shade of green? Does sunny weather change your mood or activities?

What would this planet look like without sun? What would it feel like? What would happen to life on earth? What would happen to you? Look for ways in which the sun affects life and growth. Observe the direction in which plants grow; the differences in growth between open and shaded areas; and, the ways in which plants have adapted to capture sunlight.

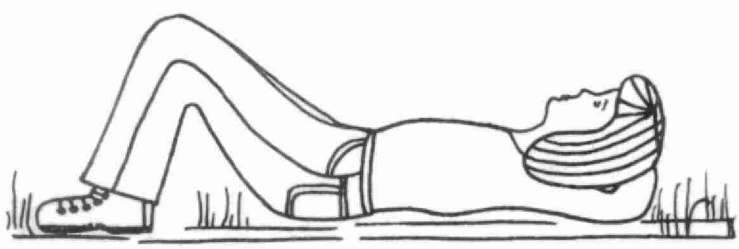
How many different birds can you hear? How many other sounds?

What new things can you smell?

Find living things in the cracks of pavement, along fences, in flower gardens, and in damp places.

Find three different types of flowers. Look closely at each. Can you see the stamens and pistil (see section on Lawns)? Watch closely. Do bees come to pollinate it? Do birds? Butterflies? Beetles? Ants? Watch the flower at different times of the day. Does it close up at night? How long does it live? Can you collect its seeds when the flower dries up? Does it have anything special for protection (against the weather, animals, etc.)?

Lie down on your back and look up at the sky. Find some clouds and watch them closely, observe their shapes and how they change. What shapes can you see? Take an imaginary trip on a cloud. What can you see?



(If you should happen to come across a cut through a hillside where road construction is occurring, refer to Activity III in the section entitled "Digging Deeper".)

On A Fall Day

Autumn, with its bright leaves and crisp, invigorating air, is the perfect season for outdoor investigations.

What sort of sound do the brittle autumn leaves make under your feet? What can you smell? How does this season make you feel?

Can you see any signs of the plants and animals getting ready for winter? Do you see any seeds lying on the ground? Are any birds flying south? Do they fly in a special pattern? Are any of your neighbors planting flower bulbs in the ground? How do some people prepare their gardens for winter?

Look for signs of change: the rusting of metals and the cracking in pavement; and fading and discoloration and peeling of paint.

Look for things that fit the following descriptions: fat, thin, sweet, smelly, square, round, old, new, large, small, sturdy, delicate, ugly, pretty, crooked, and straight.

On A Winter Day

Don't hide away indoors when the cold weather comes! If you do, you'll miss the true beauty of winter. Put on your hat, coat, gloves, and boots. Nature isn't asleep. It has just donned another dress and is waiting to show you all sorts of new and exciting things.

The winter landscape lacks the variety of color and assortment of plants that mark the other seasons but it makes up for it by the vast amount of details which it offers the observant.

A winter walk will reveal things that are often overlooked in the more colorful seasons. What animal walked across our yard last night and left his footprints in the snow? Do our footsteps make the same sounds in crunchy and powder snow?

What happens to the snow when it melts in the city? In the country? Do all types of snow stick to mittens? What things are wearing snow hats? Why is the snow piled up higher in some places than others?

What things are smoking? Are you smoking?

Are there more icicles in sunny places or shady places? What do the icicles look like?

How does the air make you feel? Can you hear better on a winter's day?

What trees still have leaves on them? Do those trees have wide or narrow leaves? Do those trees ever drop their leaves? How do the trees look different in the winter from the way they looked in the summer? Show bare branches of trees which have prominent leaf scars (see section on "Trees"). Take the children to see a tree they have already observed in summer and early autumn. Have them look for any marks on the twigs that might show where the leaves have been. Show them that the evergreen tree does not show any lateral (or side) buds, while deciduous trees do. (Evergreen, coniferous, trees as a rule never have lateral buds, though they do have terminal buds on the tips of their branches.) Is there a pattern in the bark of the trees? What stories do the twigs tell us about themselves?

Can you see any insects (see section on "Winter Insects")? Where are the insects that bothered us last summer?

On A Rainy Day

Put on your boots and raincoat and enjoy a rainy day. Observe how the rain strikes the soil, the sidewalk, grass, and trees. Do the raindrops cling to leaves? Flowers? How? Can rain make the soil move? How do the leaves cushion the force of the raindrops to protect the soil.

Does the air smell different? What sort of things do you smell? How does the rain feel on your face.

After the rain, look for bird tracks in wet mud. Some birds walk, others hop. How is the walking track different from a hopping track?

On A Windy Day

A windy day can be really exciting. Observe how the wind moves flags, clouds, leaves, seeds, and soil. Show how grass and shrubs keep the soil from blowing.

Can you hear the wind? How does it make you feel? Are all windy days the same? Find ways wind affects us (examples: helps to dry clothes; tells us what to wear). What kinds of things do you do on cold windy days? Warm windy days? Does wind affect animals?

On A Dark Night

Appreciating the wonders of nature does not have to end with the approach of night. Life is a continuous cycle and there are many interesting things happening out there in the dark.

Listen to the night. What sounds can you hear? Do you hear the leaves? Soft padded footsteps? Crickets?

Put your hands behind your ears and cup them. Can you hear more night sounds? How do you think night creatures, such as bats, find their way about in the dark?

Can you find your way around just by using sound? Stand in one spot and close your eyes. Begin to clap your hands and slowly move around. Can you hear echoes from your hand claps? Do they sound different as you move toward or away from a large object, such as a tree or a wall?

If you live close to a stream or a pond, you can hear frogs and toads croaking. Why do they do this?

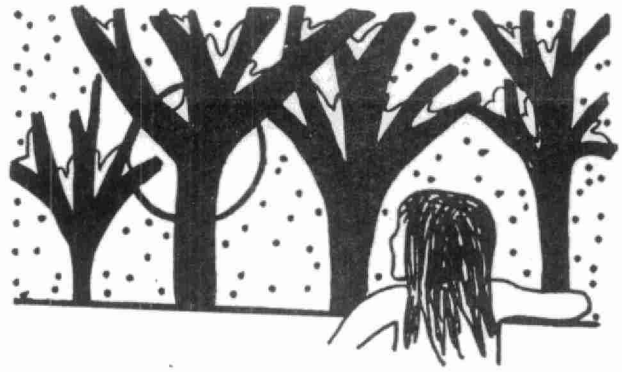
Are there sounds that make you feel angry, sad, beautiful, afraid, happy, or tough?

What can you smell at night. Does the night have stronger odours than the daylight hours? "Follow your nose" around a dark yard. Which flowers have strong scents?

During the summer months, lie on your back in the yard and look at the stars. Do you know which star is the North Star? Can you find the Big Dipper?

Observe the moon from a bedroom window or from outside. Watch it change its shape and color as the seasons pass.

A brightly-colored light in the dark attracts insects. Experiment with different colored lights such as blue, yellow or red. Which light attracts more night life? Talk to fireflies with a flashlight.



Additional Activities

- Reading good story books can extend visual impressions into word pictures. Illustrations will show how others see a scene.
- Read some poetry on nature subjects.
- Looking for photographs of nature's sights in magazines will help recall and expand experiences.
- Painting and drawing are ways for children to record what was seen and felt.
- Translating their feelings into a dance could be fun for young children.
- Design a calendar. Mark when it is time to build a garden. When the first spring plants appear. When the first snow begins to fall. When the birds fly south.
- Think up positive things to say about the animal creatures which you dislike.
- Make a Crystal Garden or a Wakeup Garden (see Section entitled "Let's Build").

NATURE HIKES

Nature hikes can be exciting adventures for both children and adults. But it is up to you as an adult to encourage this spirit!

Hikes do not have to be one-time outings. Experience the woodlot or the beach before breakfast when the sun is rising or after dinner when the sun is setting.

Avoid long hikes on very warm days or around mid-day when the sun is the hottest. Advise the children to wear shoes that will protect their feet as well as ones that will stay on (no thongs, please) and clothing befitting the season and temperature.

As a leader you do not have to be a naturalist to lead this hike. Being able to rhyme off the names of all the animals, plants, trees, birds, and insects is nice but not nearly as important as being able to get your youngsters to see, touch, or smell the environment. Children will never remember the names of all the things they see but they will remember how nice a flower smelled or how rough a piece of bark felt. Your basic goal is to encourage children to greater observations and insights.

Always carry a bag equipped with crayons, paste, a magnifying glass, rubbing paper, string, etc.

GUIDELINES

Begin the hike by reminding the children that you do not pick wildflowers, break branches from the trees, crush toadstools and mushrooms, destroy spider webs, or step and run through the woodlot without looking out for the tiny, new trees that are trying to grow in the soil...In other words, you are going to be quiet, courteous, and aware that you are guests of nature. All you will leave along the way are faint footsteps.

The general approach that should be used is frequent and short stops along the way which will depend on the children's interests and their attention span. Stop every time you notice well-known trees, plants, insects, unusual patterns or designs in tree bark, animal homes, birds and bird nests, animal tracks, or feathers. In other words, point out to the children the world they are living in.

Look for colors, light, and shadows. Look for size comparisons like a tall tree and a tiny seed; a child and an ant. How many different shapes of leaves can you see? Are there any baby trees growing along the trail? Are they the same species as a nearby large tree?

Feel lichen growing on a tree and compare it with the feeling of moss. Feel the bark of several different trees. How is it different? Describe.

Smell the leaves on the ground. Then smell the leaves from a nearby bush. Do they smell the same? Why not?

Look at the tree branches in the winter. What do they tell us about themselves? (See section on "Trees".)

Does snow look and feel the same in all parts of the wood?

How much light is coming through the trees? Lie down on your backs and imagine you are baby trees trying to find the sunlight. Is this a good place to grow? Try and find a better home.

Listen for bird calls, wind, and rustling leaves. Which sound is the loudest? If you were a rabbit, where would you want to hide along the trail? Pretend for a moment that you are going to move into the forest, where would you make your home? How many different kinds of insects can you find on the bark of a tree? How many can you find on the ground underneath the tree? Look underneath rocks for life but remember to turn the rock back over the way it was.

Allow the children to explore and no doubt you will be surprised at how observant they become. Let them tell their adventures to other children and to point out their precious finds.

Walk along the same trails in all the seasons. Notice the changes. Try to walk through contrasting environments such as an open field in comparison to a dense woodlot; a swampy area and the beach; along a road in comparison to along the forest's edge. These diverse habits will maximize the possibilities for an enjoyable and happy hike.

Art Activities

The Indians and colonists used the natural materials in the woods to get their colors for dyes. Find as many things in the woods that you think might give a color and try them on pieces of paper.

Make a rubbing of as many different shaped leaves as you can find.

Things in the woods feel different. Some feel smooth and some feel rough. Find something that is smooth and something that is rough and make rubbings of them.

There are many animals in these woods. Most are hiding. Some come out to hunt at night. Some live under rocks or in dead logs. See if you can find one and draw a picture of it from below. Show how it looks from the top and from the sides. See if you can find the name of the animal in a book and write its name under your drawing.

In the fall most plants produce seeds. Inside you will find a baby plant. Find as many different kinds of seeds as you can and paste them in your notebook.

For other art ideas and to learn how to make rubbings, see "Arts and Crafts" section.

Branching Out: a tree study

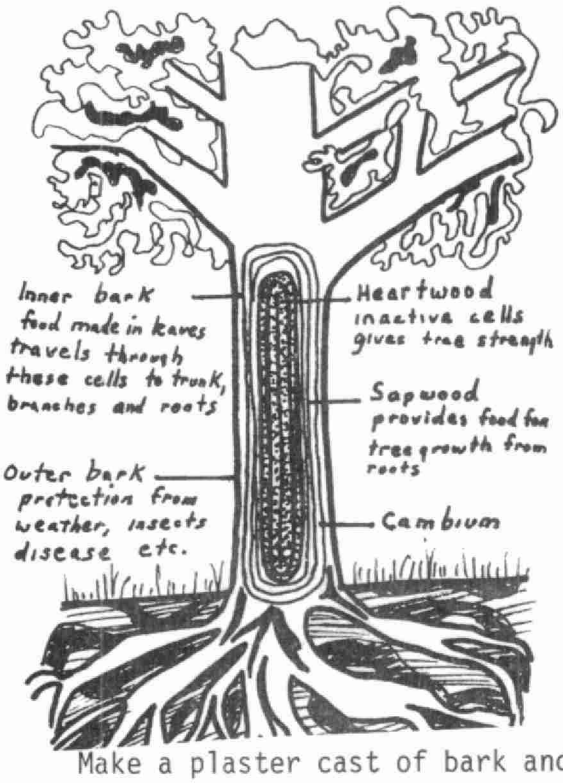
Background -- Trees

Trees are considered plants because they make their own food and reproduce themselves. Under normal circumstances, they have a single, thick, woody stem or trunk.

All trees have flowers. Some trees have very conspicuous flowers, such as fruit trees and the magnolia; other trees have flowers which lack petals and are thus harder to see, elms and some maples. Alders, birches, oaks, and nut trees have flowers called catkins. The dogwood has many small flowers surrounded by white or colored bracts.

The bulk of a tree consists of non-living material. Almost all the trunk is made up of dead tubes which carry water up to the leaves.

The living part of the trunk is a relatively thin cylinder just under the bark. Ring barking a tree, which is the removal of a complete ring of bark, will immediately kill the tree because no food will be able to travel down from the leaves to keep the roots alive.



The very centre of an old tree does not even carry water and often rots away to form a hollow tree which can grow quite rapidly as long as the outer section is healthy.

The tough outer part of the bark protects the growing layer, called the *cambium*, inside the trunk and branches from insects, fungi, and other enemies.

Activities

How does the bark on different species of trees differ? Do the cracks in the bark run up and down or sideways? On all trees? Can you see different shades in the color of the bark? Is there any relationship between the texture and color of bark? Is there any difference between the bark in the top and the bottom of the tree? Does the bark on trees crack? What caused the pieces of bark to separate?

Make a plaster cast of bark and/or a bark rubbing. See "Arts and Crafts" section.

Measuring A Tree -- How Tall Is It?

Hold a pencil at arm's length vertically in front of you. Walk forward or backward until the bottom of the pencil matches up with the bottom of the tree and the top of the pencil appears to touch the uppermost part of the tree. Stand still. Do not change your position or tilt your head.

Turn the pencil into the horizontal position. Keep one end in line with the base of the tree and ask a friend to walk away from the trunk at right angles to your position. Tell your friend to stop as soon as he or she appears to be at the end of your pencil.

The distance between the base of the tree and your friend is equal to the height of the tree and can be measured with a tape.

Background -- Coniferous and Decidious Trees

There are two main types of trees: conifers (evergreens) and decidious (broad-leaved trees).

Conifers

Conifers are also called evergreens because their needles do not appear to turn brown and fall to the ground at the approach of winter. Actually, conifers slowly loose their needles throughout the whole year. (The one exception is the larch tree, which sheds its needles every fall.)

Generally, coniferous trees have narrow needles and their wood is softer than those of broad-leaved trees. They are, therefore, also called softwoods.

These trees have both male and female cones which begin to grow in the spring. The female cones develop near the tips of new shoots and are red when they first begin to grow. The male cones are usually quite small and yellowish and are grouped in large clusters at the base of a new shoot.

The scales of the male cone carry the pollen sacs that are full of yellowish pollen. In spring, the wind carries the male pollen to the female cones (this occurs only in dry weather, which causes the female cones to open a little to allow pollen to enter) and the small female cones begin to swell and become woody as fertilized seeds develop between the scales.

The seed itself has a thin "wing" growing from it and when the cones open the seeds fall out and are carried away by the wind.

Broad-Leaved Trees

The leaves of broad-leaved trees differ in size, edging, color, vein patterns, texture, and arrangement on a stem.

In summer, the leaves act as reservoirs of water for the tree. Some of the water evaporates into the air and this forces the tree to draw up more water from the roots. When the leaves fall off the tree in the fall, the moisture left in the roots, trunks, and branches is preserved. Thus, shedding their leaves protects the tree.

(In tropical climates, hardwood trees keep their leaves all year round because there are long hours of daylight to prevent trees from withering. They are called broad-leaf evergreens.)

Background -- Twigs, Buds, and Scars

Playing tree detective in the winter can be a lot of fun. By taking a close look at a tree after its leaves have fallen, you can find out where the tree will grow next spring, where the spring flowers will be formed, and where the new leaves will appear.

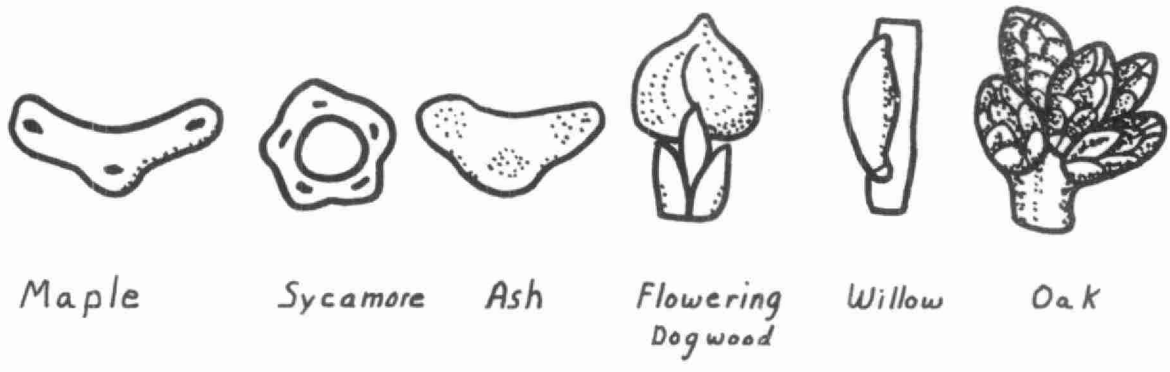
A young tree is called a *sapling*. A sapling grows higher and spreads its branches by lengthening the tips of its twigs. Eventually the trees grow into branches by getting larger and thicker.

During the summer growing season, a bud forms at the end of most twigs. This bud is called a *terminal bud*. If you look back along the twig you can see lines around the twig, called *growth rings*, or *scale scars*, that show where last year's terminal bud was located. By counting the number of these scars you can determine the age of your twig.

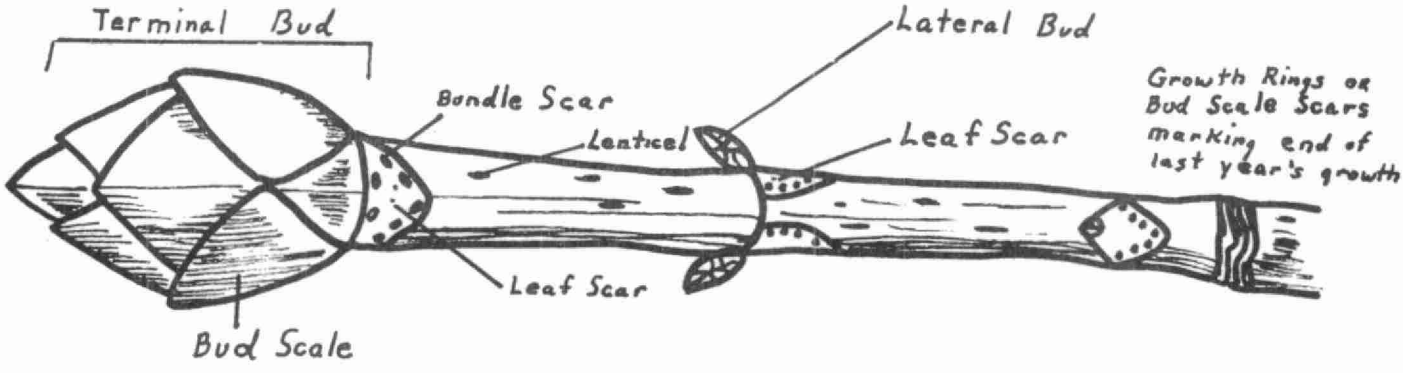
Along the side of the twig, you can also see the *lateral buds*. In the spring, these buds grow into new stems with leaves or flowers. (Usually the larger buds contain flowers, or leaves and flowers, while the smaller ones are leaf buds.)

Most buds and twigs are *alternate*, appearing first on one side of the twig, then on the other. However, four common trees have their leaves and twigs in pairs or opposite each other. These are the maple, ash, dogwood, and horse chestnut. Remember mad horse.

Just below the lateral buds are small scars. These were caused when the old leaves fell from the trees.



If you look carefully at the *leaf scars*, you will see little dots known as *bundle scars* which are the ends of the veins which carried *nutrients* (food and water) to and from the leaf. The leaf scars and bundle scars make a pattern which is different for each species of tree. Some of them take on the appearance of faces.



Along the bark, there are tiny holes called *lenticles*, where the air passes in and out of the tree.

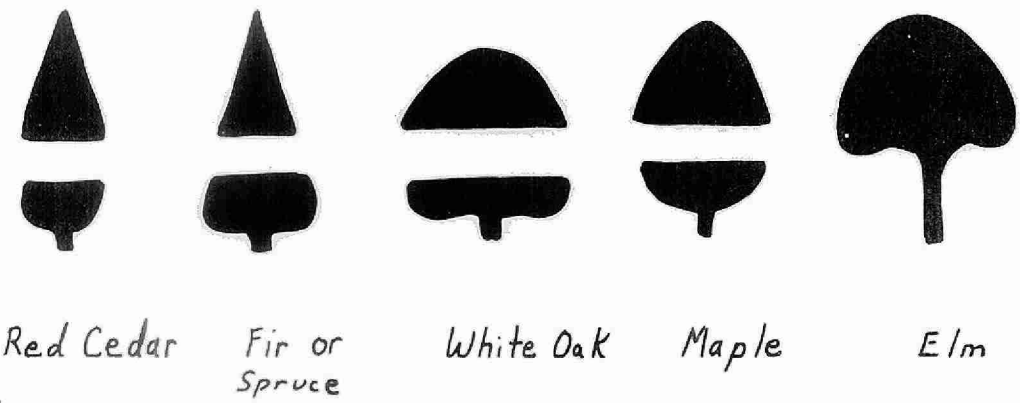
Activities

Find a twig that shows buds, leaf scars, bundle scars, scale scars, and lenticles. Do coniferous tree twigs have any of these features (see section "Let's Take a Walk -- On A Winter Day")? Do you see the difference between a leaf bud and a flower bud? Are all twigs the same color? Are buds found on trees at all seasons of the year or only in one season? Is there always a terminal bud at the end of each twig? (Some trees do not have terminal buds. In these cases the twig keeps growing until the food supply falls off. The twig then dies back to the last lateral bud, which becomes a false terminal bud with a small round scar (different from the leaf scars) at its base where the branch died back and fell off. These buds are usually set at an angle (examples: linden elm and sycamore). How does a twig change from season to season?

Carefully open a large bud and look inside. Are the buds hard or soft when squeezed gently? Do all buds have the same number of scales (except for the willow, which has a single, caplike scale that covers the bud, buds are usually protected by several scales)? Which buds develop faster, leaf buds or flower buds? Are there equal numbers of leaf and flower buds on a tree?

Background -- Branches

Branches are the arms that give a tree its typical shape. Examining how the branches grow from the trunk is a good guide to tree identification.



Activities

Do more branches grow in one particular direction? If so, which direction? Does this pattern occur in other trees of the same species? How would other trees or objects, such as buildings, affect the branch pattern? In what direction do the prevailing winds blow your tree? Compare the bud arrangement to the type of branching in the tree.

How do we explain an evergreen's leaves? Look at a pine needle carefully. Where are the *stomata*, the little pores where air and moisture vapor pass in and out? Can the leaf cover these in winter? If you go into a conifer forest, you will notice a rather pleasant but strong smell. Find a tree which has been injured in some way. Something has healed it. We call it gum or resin. Cedar trees have an oil. Take a good look at some of this material on the bark of a tree. It is a clear liquid. How would you describe its scent? Spread some on paper. Be careful not to get it on your clothes or hair. Let it dry. Is it really waterproof? It protects the tree from infection by insects, or germs or spores, which float in the air.

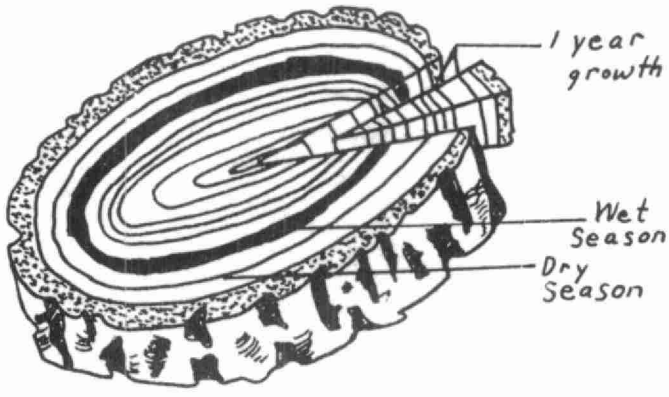
Crush some cedar leaves and sniff. Evergreen leaves have a layer of this waterproof material just under the tough surface. It prevents drying out.

What are the advantages or disadvantages of the two methods, broad-leaf (decidious) and coniferous (evergreen) trees use to protect themselves in the winter? Do evergreens hold their leaves forever? How long? (Look at a young tree for the answer.)

Additional Comments

How old is a tree?

If you look at a cross section of a tree trunk, you will see that it is marked by a series of rings. These rings can tell the approximate age of a tree. Each growing season, a tree adds a layer of new wood to its girth. During the cold months, when the sap ceases to flow, growth is temporarily halted and the tree rests. Thus the rings are clearly halted.



Width of the rings varies from year to year with the climate. Dry seasons produce narrow rings; wet seasons, broad rings.

Do trees sleep in winter?

A tree which has lost its leaves is said to be dormant or "asleep". Its roots continue to grow, using food stored during the summer. On its branches, buds develop into tiny replicas of leaves and flowers. Each bud has its own storehouse of food and is covered with tough scales that protect the tender embryo leaves against loss of water. A few warm days and longer periods of daylight cause buds to open and develop. If warm weather comes followed by a cold snap buds may open up only to be killed.

Background -- Seeds

A single tree may produce thousands of seeds every year. (The seeds of conifers are contained in the cones that hang from the branches. Apples and oranges contain seeds inside each piece of fruit. The seeds of nut trees are the nuts themselves.)

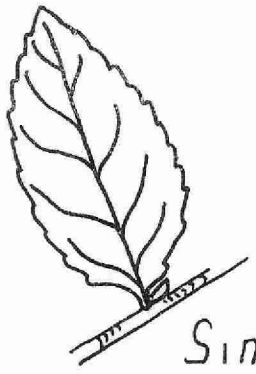
Each seed contains all essential elements to produce a new tree but usually less than one in a million survives to maturity.

Buds and insects eat most while still on trees. Squirrels and chipmunks live on seeds of nut trees. Many seeds fall on barren or rocky ground. Only a few out of all the millions of seeds manage to germinate and put out tiny roots.

However, the little sprouts then crowd each other in their fight for sunlight and nourishment from the soil and only the hardiest survive. This fight for sunlight continues for many years. It has been estimated that in a single acre of natural pine woods, roughly 5,000 trees die after they are 20 years old.

Background -- Leaves

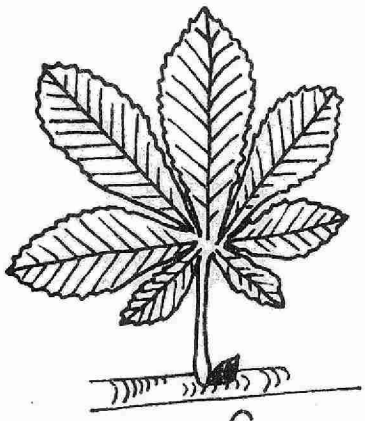
A *simple* leaf has only one leaf on a stem and a *compound* has many leaflets on one stem.



Simple Leaf

A tree, like all plants, inhales carbon dioxide. The tree then breaks it down into carbon and oxygen. At the same time, the tree breaks down the water that comes from the roots into hydrogen and oxygen.

Then *chlorophyll* -- a substance that makes leaves and grass green -- acts as a chemical agent. Using sunlight as energy, it combines the molecules of the water and carbon dioxide and forms them into sugar, which is the food upon which the tree lives and grows. The process is called *photosynthesis*. (The word is a Greek one coming from *photo* meaning light and *synthesis*, putting together.)



Compound Leaf

Why do leaves change color?

In cold weather while the tree sleeps, the chlorophyll is not needed for its work of changing air and water into food-sugar. As the chlorophyll fades and the leaf begins to slowly die, other pigments become dominant and the leaf changes its color to yellows, reds, and browns.

Why do leaves fall off the tree?

The shorter periods of daylight affect a special layer of cells at the base of each leaf where it joins the twig from where it grows -- the *stipule*. In the fall, as the days grow shorter, this cell layer weakens and the leaf turns brown and drops from the tree.

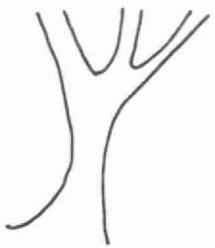
Activities

Collect and examine leaves. You will find plenty lying on the ground in the fall. Use an identification book and identify leaves by shape, texture, and color. Make a scrapbook of as many different types of leaves as possible.

Make leaf prints, rubbings, and/or sun prints (see section on "Arts and Crafts").

TREE CLASSIFICATION CHART

By carefully recording the different characteristics of the trees you find and then looking up the name in a guide book when you return home, you can learn to distinguish one tree from another. This form could also be filled in by children before a field trip and used as an identification chart. In this case, however, the adult should list the names of the trees that may be found in the area.

Shape	Bark[1]	Leaves[2]	Buds[3]	Flower[4]	Fruit[5]	Outstanding Feature	Name
							
							

Note: Obviously, the seasons will influence which columns can be filled in.
1-5 -- for description see following page.

1. Bark - texture and color
   shaggy, in long, loose strips -- Shagbark Hickory
   gray, mottled with yellow -- Sycamore
   white, peeling -- White Birch
   light gray, smooth -- American Beech

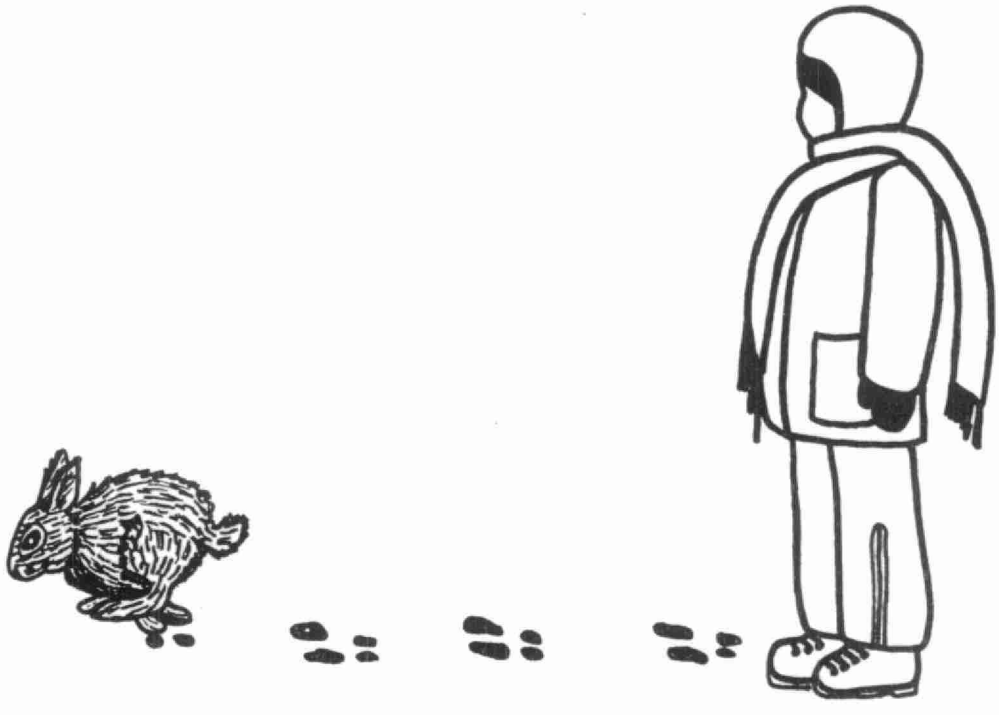
2. Leaves - note whether they are simple or compound leaves. (To distinguish a simple leaf from a leaflet of a compound leaf, look for the new bud at the base of the leaf stem.) Notice the edge as well as the whole shape of the leaf. Are the lobes rounded or sharp? What is the texture? Leathery? Crisp?

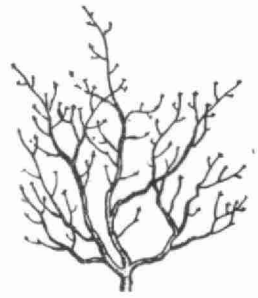
3. Buds - note the color, number of scales, texture, and shape of buds.

4. Flowers - conspicuous -- fruit trees and magnolia
   lacking petals, harder to see -- elms and some maples
   catkins -- alders, birches, oaks, and nut trees
   many small flowers surrounded by white or colored bracts -- dogwood

5. Fruit - the structure which follows the flower and contains the seeds
   fleshy fruit -- apple, cherry, pear
   winged fruit -- maple, elm
   cone -- conifer
   nut -- beech, hickory
   acorn -- oak

Winter Wonderland: snow study





TAKING A CLOSER LOOK AT SNOW

I Background -- New Snow

During the cold winter months, snow crystals begin to form in a layer of the atmosphere, some nine to ten kilometres above the earth, where the temperature is approximately -34.4 to -37.2°C, and where there are cirrus clouds and only a small amount of water vapor.

The crystals develop from water molecules which stick to the microscopic particles of salt or dust carried into the atmosphere by the wind. In its earliest form, a snow crystal is merely a plain hexagonal shape of transparent ice.

As the crystal falls through the various layers of clouds in the atmosphere, more water molecules stick to it and form six arm-like extensions. Ice fills in the empty spaces and the process continues -- six more extensions, spaces fill in, etc. As the crystal gets closer to the earth, it grows more rapidly due to the increasing amount of water droplets created by warmer temperatures.

The crystal then falls through the nimbostratus clouds, where the temperature is between -15 and -12°C. It continues to float back and forth, continuously growing until it reaches about 0.4 cm in size and is heavy enough to fall to earth.

Activities

1. Catch a snowflake on your mitten. Look closely. Is each snowflake the same? Are there basic types of snow crystals? Do any of the flakes appear broken? What may have caused them to break?

2. Make slides of snow crystals (see "Snow Slides" in "Let's Build" section).

II Background -- Old Snow

Although snow falls as delicate crystals, it is transformed into granular crystals due to an evaporation and recondensation process -- the fine points evaporate and this evaporation causes the air around the crystals to become moist. The moisture then recondenses and deposits particles of ice on the flatter, smoother crystal surfaces.

Smaller, rounder crystals are easier to ski and toboggan on because they roll under a moving object in an easier manner than do the more sharply-edged new snow crystals.

Activities

Look at piles of old and new snow and note any difference in their shapes. Did the snow closest to the ground (the old snow) fall in the same shapes as it is in now?

III Snow Drifts -- Shape and Structure

Select a drift with a good shape and an overhang (called a cornice). Using a ruler, slice the drift so a cross-section is exposed. Look for layers of thick thin, clean, dirty, icy, or crusty snow. (These layers are called strata.) What may have caused these layers.

IV Background -- Snow Temperatures

Because of the reflection from the snow's shiny crystals and the air spaces between the crystals, heat cannot move through snow. Thus it is a good insulator.

A layer of snow covering the ground will keep the temperatures of the soil beneath it fairly constant during the winter, even if the air temperature changes greatly. On a very cold day, the snow helps maintain a 17°C between the air and soil. On a warmer day, the snow keeps the soil cooler than the air.

Activities

1. Take temperature readings at different depths in a snow drift by inserting the thermometer horizontally into the drift.

2. Try to find the warmest or coldest spot in your yard.

3. Dig down to note the condition of the soil. Is it frozen or not? What is the color of the grass? If the snow is frozen and if plants cannot grow when they are frozen, how do spring flowers grow through the snow? (The soil is not frozen.)

V Snow Density

Things to think about:

1. Which melts faster, an ice cube or a snowball both weighing the same amount?

2. How many cups of snow are needed to make one cup of water? (Freshly fallen snow has a lot of air between its crystals: it may, therefore, take up to ten cups of snow for one cup of water.)

3. Will 30 cm of newly fallen snow still measure 30 cm in depth a week later?

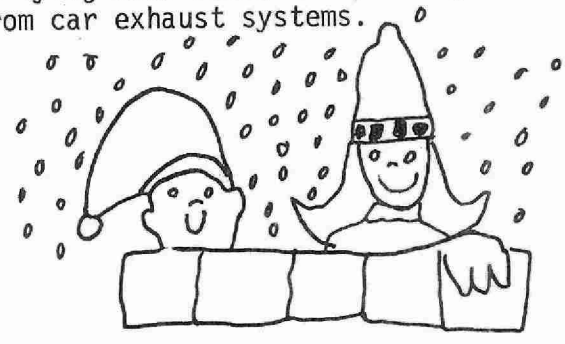
4. Stick a snowball on the end of a pencil. How long will it take for the first drop of water to fall off. (The porous nature of snow allows water to soak in between the crystals.) It may take up to one hour.

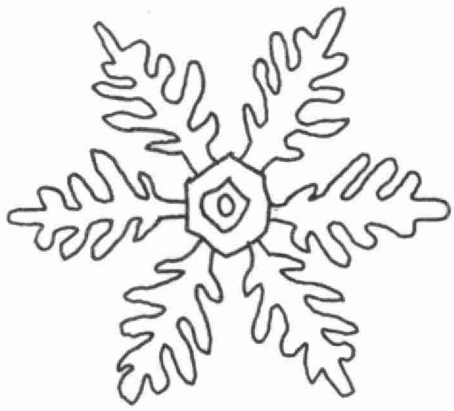
VI Background -- Snow and Pollution

As snowflakes fall through the atmosphere, they may pick up dust and small particles emitted into the air by industries. Snow lying near roads and parking lots may also become dirty due to the pollutants from car exhaust systems.

Activities

1. Test how clean the snow in your area is.





Equipment - clean container, saucer, or glass
- filter paper or paper towelling
- funnel
- clean jar or container
- magnifying glass

Method:

1. Wait until a snowfall and then collect snow in the container. Cover the top so that no dust can settle into it and wait until the snow melts.

2. Examine the paper towelling for any specks and then place it in the funnel.

3. Pour one-half of the melted snow through the towelling and funnel into the jar.

4. Examine the towelling or filter paper with a magnifying glass.

5. Compare the melted water with the filtered water.

Questions:

Why is it important to examine the filter paper before pouring the melted water through it. What can you see on the filter paper? What do you think caused the particles on the filter paper? What differences can you see between the melted water and the filtered water?

You may wish to continue this experiment by collecting snow from various areas of your property and comparing it.

VII Other Winter Activities:

1. Collect weather data

2. Write a poem

3. Make a collage about snow.

4. Using powdered tempera paint and a container with holes in it, make a snow painting in the yard.

5. Take a good look at trees (see section on "Trees").

6. Look for winter insects (see section on "Insects").

7. Make a crystal garden (see section "Let's Build").

8. Play outdoor winter games (see section on "Games").

World at Our Feet: a lawn study

THE WORLD AT OUR FEET: LAWN STUDY

While sitting outside on a hot summer's day, did you ever stop to wonder about what is happening in that miniature grass forest at your feet. Is there a war going on? A food hunting expedition? Has a new species of plant sprung up?

There are a lot of things to look at when you get down on your knees and practice a bit of "belly botany".

One parent got his children interested in this type of field activity in a rather unique way. One day when his children were playing in the backyard, he sat down on a chair outside and began fashioning a noose out of a piece of rope. He worked silently until his children began to question his actions.

"I'm going to lasso an ant," he said. Lasso an ant! Now he had their undivided attention.

Dad threw the rope onto the ground, making a large circle. All three then got down on their stomachs and began to search. They did eventually find one, but in the meantime they got a close look at a dandelion, some clover, a lady bug, and an earthworm.

By looking carefully, you are almost certain to find an ant in your lasso. If not, try again -- they are slippery little creatures. If you are not the cowboy type, however, you could use a hula hoop or even build your own special quardrant.

Equipment:

- tent pegs, wooden stakes, popsicle sticks
- measuring stick or tape
- string

Instructions:

1. Using the tape, measure out one meter on the ground.
2. Push a stake into the ground at either end of the tape.
3. Place one end of the tape at a ninety degree angle from one of the pegs. Measure out a metre and insert peg.
4. Repeat. You should now have a square.
5. Tie strings between all pegs.

BACKGROUND INFORMATION

The physical setting, the climate, animal life, vegetation and soil all affect each other and influence the types of organisms (living things) that can exist at that site.

Physical Setting: In an open area, the organisms present must be able to withstand harsh conditions, such as wind, extremes in temperature, and lighting (day and night) and periods of flood and drought.

On the other hand, organisms dwelling in a forested area are more protected from these sort of problems.

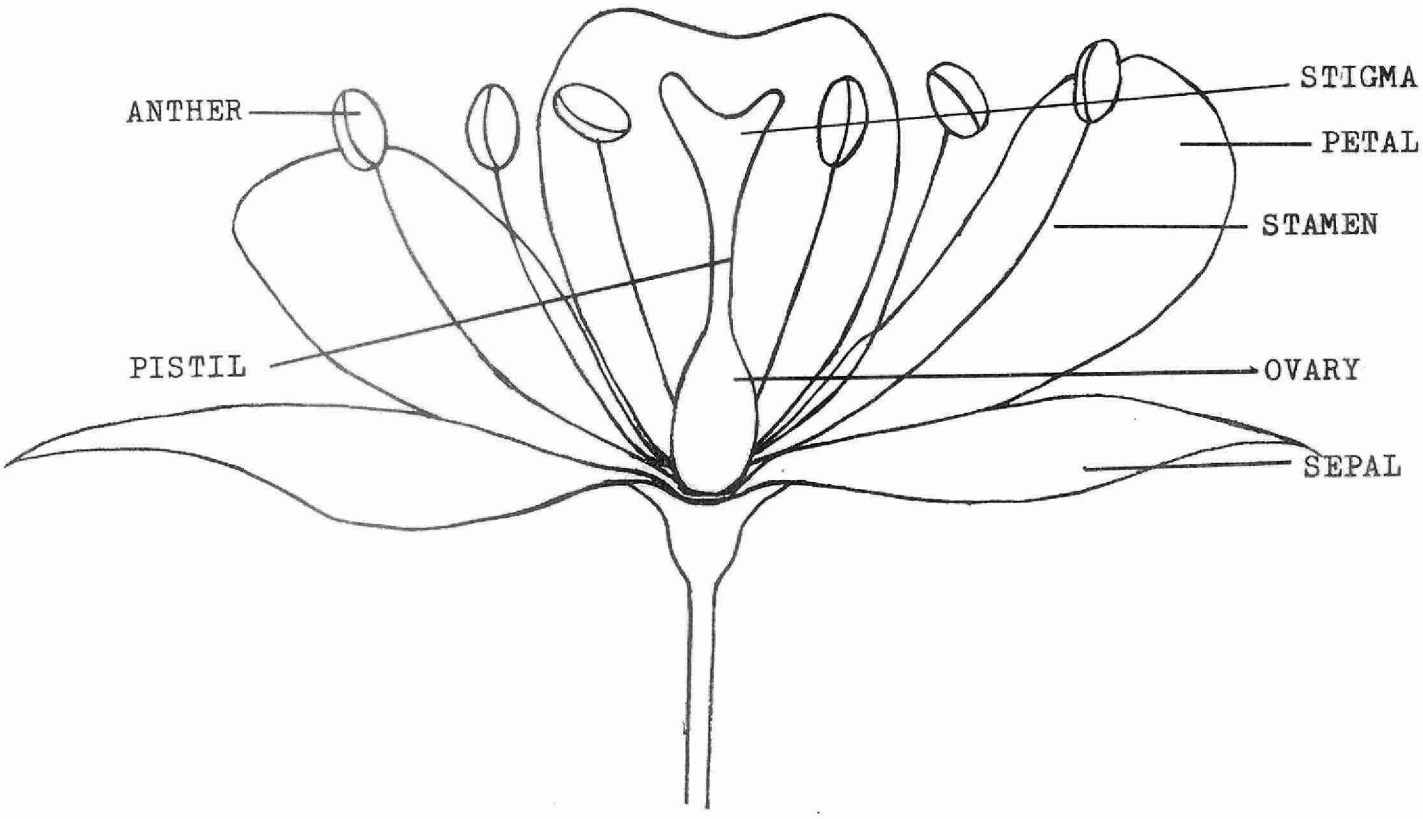
Soil is another physical factor which determines the types of animals and plants found at a site. For example, only the organisms which are tolerant of an acidic soil can live in a coniferous forest. (Pine needles decompose to form a very acidic soil.)

Vegetation: A *pistil* is the workshop of the flower. At the bottom of each pistil is an ovary, in which tiny seeds, called *ovules*, are formed. (Some ovaries contain only one ovule.) Each ovule contains an egg cell.

When a pollen grain is transferred by insects, birds, the wind, etc. from the male part of a flower -- *the stamen* -- to the female organ -- *the stigma* -- (this is called *pollination*) the pollen grain forms a tube that grows downward to touch the egg cell in the ovule. The ovule begins to grow and develops into a seed. The seeds stay in the ovary until they are ripened and ready to be scattered by the wind, animals, water, man, or by expulsion.

Some flowers have both a pollen-bearing stigma and a pistil with an ovary. These are called *perfect flowers*. Others may have only the stamen (*male flowers*) or only the pistil (*female flowers*).

PARTS OF A PERFECT FLOWER



The *corrola* is composed of the petals. In many flowers, it is made up of separate petals. In some, as in the petunia and morning glory, the corolla is completely in one piece.

The *sepals* encircle the petals and protect the flowers. All the sepals together make up the *calyx*. Sepals are really specialized leaves, varying in different kinds of flowers in size, shape, and numbers. Often they are green, as in roses, or they may be the same color as the flower, as in tulips, for example.

Plants which depend on insects for pollination are usually colorful and have a sweet-smelling nectar to attract the insects. Wind-pollinated plants have no need for color or odour. However, they adapt in other ways. Grass, for example, has long, protruding stamens, bearing an abundant load of pollen to facilitate wind pollination. In addition, the fine, flexible structure of grass allows it to bend easily and rub against adjacent plants to transfer the pollen.

Animal Life: An insect's structure is often adapted to its habitat. Organisms, such as the earthworm, which live in moist soil, often have a moist skin, whereas organisms found in a drier habitat have a thick, hard outer shell, beetles for example, to prevent drying out.

Often the insect species has a coloring which helps it to blend in with its habitat.

THINGS TO LOOK FOR

I. Physical Characteristics:

(a) Is the soil wet, moist, or dry? What color is it?
(b) Record the temperature on the ground and about four feet above the ground. Compare the temperatures. Do you think that temperature plays a role in the survival of life in the quadrant?
(c) What type of terrain is the quadrant in? Is it open and flat or is it steep and rolling?
(d) Is it sunny and hot or shady and cool?
(e) Is it windy or is it calm? What direction is the wind blowing?
(f) How does a site affect the vegetation? The animal life?

II. Vegetation

(a) Is the width of all grass blades and their heights the same throughout the plot? Is there more than one species of grass? (See identification section page 117.)
(b) Can you find different colors of vegetation?
(c) If seeds are present, how did they get there and where did they come from?
(d) Are the plants in the quadrant low growing or creeping, or are they bushy and tall?
(e) Can you find any dead or decaying vegetation? Why is it important?
(f) If dandelions are present, are they in flower or have they all gone to seed?
(g) Can you find any clover with more than three leaflets?
(h) Is moss found in dry or moist places? What does it feel like?
(i) Are there any wildflowers in your quadrant? Do they have a strong or a weak scent? Why is this important?
(j) By looking at the down in the flower heads of thistles and the spines on the leaves, how do these features adapt it for survival?
(K) How does the vegetation affect the animal life?

III. Animal Life

(a) Do you see any insects such as bees, wasps, or flies hovering over a particular type of vegetation?
(b) What kinds of sounds can you hear?
(c) Are there any insects such as aphids, grasshoppers, or leafhoppers on the plants? (See "Insects" -- Identification Section.)
(d) Are they moving? How fast do they creep?
(e) Can you find the same insects in both short grass and in long grass?
(f) Have the children get down on their hands and knees and carefully part plants so that they can see the ground surface. Spiders, beetles, land snails, slugs, larvae, mites may be found. How are these animals suited to their environment?
(g) Can you find any evidence of animal life such as worm castings, worm holes, ant hills, or spider webs?
(h) How does the animal life affect the vegetation?

Additional Activities

This activity can be repeated in different areas: under a tree, beside a driveway, in a forest, a field, etc. It can also be done in the same setting from spring to fall. You should see a variety of changes as the seasons alter.

Wading in: a stream study

From watching children or adults at a pond or stream site, it is evident that some think throwing rocks or trying to catch minnows are the only interesting things that can be done in that environment.

How wrong they are! And how destructive! For in almost any body of fresh water, temporary or permanent, large or small, you have an aquatic habitat which provides the community that lives there with all of its basic needs. This community is composed of animals and plants -- some so tiny that we have to use magnifying instruments to see them -- whose way of life can be easily disturbed by man's thoughtless actions.

There are a number of things which you and your child can do at an aquatic site. They can range from a short exploratory walk along the banks, a study of the physical characteristics of the stream, or an examination of the organisms dwelling on the surface, in the water, in the bottom sediment, or along the shore.

It's all up to you and the amount of time you have to spend.

For those who are interested in undertaking an in-depth study, we have included instructions to build your own sampling equipment.

Please note: It should be stressed to the boys and girls that they are only guests in the aquatic community and, therefore, they should return all specimens to the water as close as possible to where they found them. Overturned rocks should be replaced in their original position, and plants that are removed should be pulled up with the roots intact and replanted after observations are made.

Choosing a Field Site

If you do intend to undertake an indepth study, pick your site carefully. You will need to wade in the water, therefore, the stream should be slow moving and shallow enough so that it does not present a danger . Avoid ecological or environmentally-sensitive areas such as waterfowl breeding grounds, sites where the shoreline is eroding, or areas with little or no shoreline vegetation.

A stream that has a very muddy bottom tends to become murky when you work in it and the samples obtained are usually poor. A slightly stony and pebbly bottom is a good choice. An ideal stream is anywhere from 1.5 to 10 m wide and no deeper than 1 m.

Building the Equipment

Materials

1. One plastic pail with handle (gallon size): Ice-cream, frozen fruit, or honey containers are also ideal.

2. Sorting trays: White or light colored dishpans are best choice, shallow aluminum foil baking dishes such as TV dinner containers or pie plates may be used. Aquatic organisms show up well against a white background so if aluminum containers are used, the bottoms should be painted white, or cut heavy white cardboard to fit inside the container. Several large sorting trays are needed for the instructor with each team possibly using a smaller tray.

3. Old spoon or hand trowel (optional).

4. Waterscope: May be made from a heavy cardboard cylinder about half a metre in length. Mailing tubes, stove pipes, poster or paper containers are ideal. If cardboard cylinder is used, it will need to be waterproofed with polyurethane or a plastic varnish. A bottomless bucket is also useful. Cellophane or clear plastic is needed to fit over one end of the tube. Instructions for use and assembly follow.

5. Microscopes (optional): Magnifying lenses are more practical for use in the field. Strings should be attached so they can be hung around the neck.

6. Eye droppers and basters: Two sizes are preferable.

7. Collecting Nets: Hand dip and flat-bottomed nets. Nets may be made from coat hangers, nylon stockings, cheesecloth, tape, and wooden stakes such as broken hockey sticks or broom handles. Instructions for use and assembly follow. Plankton and seine (minnow) nets may also be used.

8. Bottom samplers: For screening the bottom material an ideal collecting tool is a kitchen sieve or strainer. A hand screen may be used which consists of a piece of screen tacked onto a wooden frame. Instructions for the use and assembly of the hand screen follow.

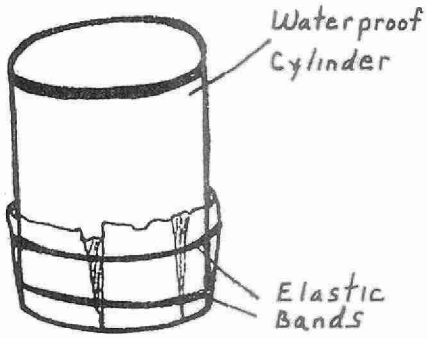
9. Containers: Small containers such as empty tin cans.

10. Clipboards, paper, and pencils.

11. Field guides: A general identification key will be beneficial while in the field. The Golden Nature Guides has a publication entitled Pond Life, which is ideal for identifying some of the more common life forms. (See also "Aquatic Insects" in "Identification Section".)

Assembly Instructions

Waterscopes



Several coats of plastic varnish will be needed to waterproof cardboard cylinders, if they are used. When applying the varnish, brush it up into the inside surface of the cylinder as far as you can reach with the brush. Cut the sheet of plastic so that when it is placed over the end of the tube it will extend 5 or 6 cm up the side. This can be kept tight and secure with elastic bands.

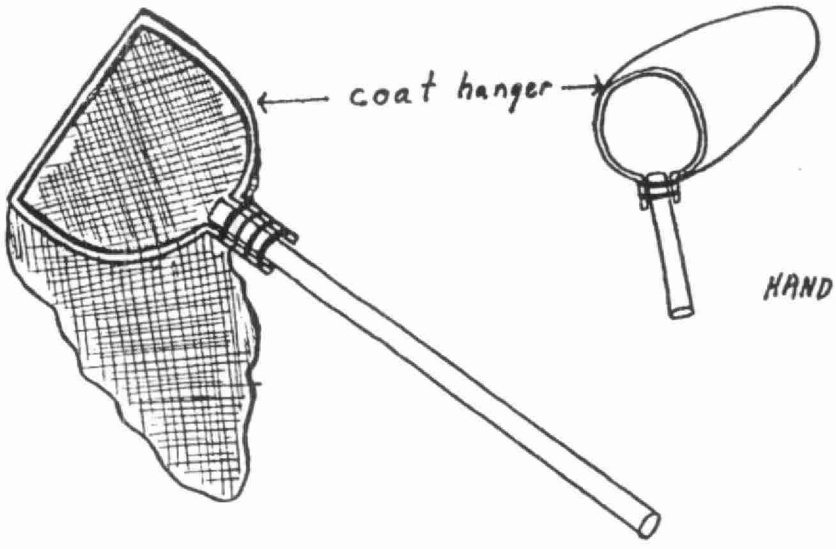
The waterscope may be used to look at the tiny animal and plant life on the stream bottom as it exists naturally. The pressure of the water causes the plastic to become a convex lens so that plants and animals appear larger than they really are.

The success of viewing through the waterscope will depend on the brightness of the overhead sunlight and the clearness of the water.

Collecting Nets

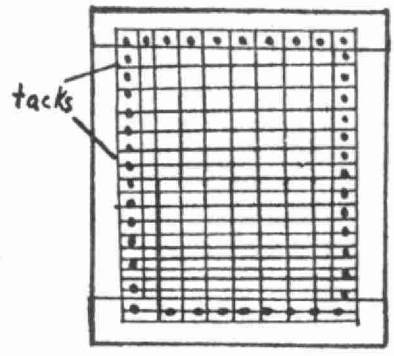
Small hand dip nets are primarily used for collecting insects and other small aquatic life on the surface of the water, among plants, and under stones and logs along the shore. A circular frame is needed for attaching the net bag. Bend a coat hanger into a ring about 8 cm in diameter. Make a net bag from organdy, nylon stockings, or cheesecloth about 12 cm deep. Sew the bag onto the ring. Fasten the ring and bag to a stick or pole about 8 cm in length.

A flat bottomed net is used to collect larger aquatic organisms throughout the water column. Bend the coat hanger wire into a D-shaped frame about 35 cm in diameter. Make a net bag from cheesecloth, nylon stockings, or netting of a 3 mm mesh, about 60 cm in depth. Sew the bag onto the frame. The frame and net bag can then be attached to a long pole of up to 90 cm in length with tape. A broom handle or hockey stick is ideal.



HAND DIP NET

Flat Bottomed Net



HAND SCREEN

Hand Screen

A frame can be built using pieces of wood about 30 cm in length. A mesh hardware screen of less than 1 mm is tacked onto the frame. Bottom mud samples are then dug up and placed on top of the screen. Water is poured over it washing the finer particles through. Large stones should be removed by hand.

Activities

I. Stream Walk

For a list of suggested topics to discuss while walking along a stream bank, see questions included in the Physical Features of the Pond or Stream, and Plant Life.

II. Physical Features of the Pond or Stream

Aquatic communities can be found in two areas: 1) in standing water, such as ponds, lakes, and swamps; and 2) in running water, such as rivers, creeks, and streams.

The rate of the water flow (the water velocity) and the amount of oxygen in the water determines which animals will be present at that particular site.

For example, in a shallow stream where the water flows very fast, carrying with it small, light particles of sediment (this is called a *riffle site*), you can expect to find organisms which are capable of protecting themselves from being swept away by the current. For example, they may possess a sucker to help them attach themselves to rocks. In addition, since this type of site is rich in oxygen (the water tumbling over the rocks absorbs oxygen from the air) none of the aquatic creatures need any special features for removing oxygen from the water.

Conversely, at a pool site, where the water moves in a large volume, its velocity is slow and the particles of sediment are beginning to settle to the bottom, the aquatic organisms are faced with limited oxygen and the threat of being buried under the settling particles.

Many organisms, such as the tube worm, that exist in a pool site have special mechanisms to combat these difficulties. The tube worm builds itself a case in which it wriggles. The wriggling action increases the amount of water, which comes in contact with the worm so that the creature has new sources of oxygen. Its casing protrudes above the bottom sediment to prevent the organism from being buried by the settling particles.

Water temperature, as well as the depth, width, and velocity of the stream are also important for determining what sort of aquatic life can survive in a particular environment.

Water velocity can be calculated by measuring the distance between two points in the stream and then timing how long it takes an object, such as a leaf, to travel between the points. The distance should be measured in centimetres and then divided by the number of seconds required to travel the distance.

distance between A & B	÷	time to travel	=	velocity of a stream
in cm		in sec.		in cm/sec.

The water temperature of a stream or pond may be taken with a thermometer and the depth with a yard or metre stick.

The following questions should also be discussed.

1. What color is the water? Is it clear, light brown, or dark brown? Can the bottom be seen?

2. What does the stream bank look like? Can you see any signs of erosion? Could the stream bank affect the color of the water?

3. Describe the surrounding country.

4. Estimate the amount of shade on the stream. Is it all shaded or half shaded? Why is it shaded? What sort of plants are growing in the shaded areas?

5. What is the weather like?

III. Microscopic Pond Life

You will need lenses, basters, sorting trays, and clipboards. One of the most fascinating aspects of animal life involves the discovery of microscopic plants and animals in the sample of water. Most small children have not been exposed to these forms and are generally thrilled to discover them. The richest collections will be found early in the fall and again in the spring.

Using the baster, have the child suck up a sample of water from: (1) the edges of the stream or pond, (2) the scum of the surface of rocks or logs found close to shore, and (3) close to the bottom mud. Transfer these samples to separate small sorting trays on shore. Have the child observe their samples with magnifying lenses and ask them to draw the specimens they see. When observations are completed, return the samples to the water.

Questions

Do you see anything moving? What color is it? How fast is it moving? How does it move? Do you see other forms? Are they the same color? The same size? The same shape? Are they plants or animals?

IV Small Aquatic Animals

You will need small hand dip nets, pails, small containers, sorting dishes and trays, clipboard, sieves, and waterscopes.

Insects and small aquatic animals will be found on the surface of the water, on and under plants, logs, and rocks, in the bottom sediment, and directly in the water.

Have the child look for insects such as the water strider on the surface of the water. Using the hand dip nets he can catch and put them in pails which are half-filled with water. Identify and record observations.

Using the hand dip net, sweep it through the water around rooted vegetation. Put any captured specimens into the bucket. Look under leaves of plants such as the water lily, and along the stems of plants for insects. They can be caught with the net and transferred to a pail. Identify and record observations.

Have the child turn over rocks and small pieces of wood in the water and, using the waterscope, look closely for any movement. Common forms such as the mayfly or stonefly nymphs and leeches may be found.

Organisms found on the rocks can be washed off by holding the rock over the pail, and pouring water over it gently. Identify and record observations.

Children are usually amazed to find living things in the bottom mud. They should be able to observe several organisms, particularly the bottom tube-dwelling worms.

The child can obtain a mud sample by either digging up the mud with the kitchen sieve or using spoons and placing it on the hand screen. Look closely for any movement. Fill the small container with water and pour it gently over the mud. Can you see anything? Pour several containers of water through the mud. The remaining sample can then be dumped into the pail (half-filled with water). The magnifying lenses may be of some help now if the child fails to observe any movement. Note: many aquatic worms are small and are clear or have a very light coloring. Identify and record observations.

The small dip net can be pulled through the water, just below the surface and then closer to the bottom of the pond or stream. Contents of the net are then to be transferred to the pail for observation and recording. The waterscope may be used here to observe the life as it exists naturally in the water.

Questions

How do the insects found on the surface of the water move? What do their legs look like? Do they make particular noises? Do they ever dive into the water?

What color are the insects found on the plants? Why would a plant be a good home?

What color are the organisms that are found on rocks? Why is this important? How do they attach themselves to the rock? Is the rock green and slimy? Why is this? Why would a rock be a good place to live? What differences do you see when the organisms are held in the air (only for a few seconds, we do not want to harm them) and when they are put back into the water.

What color are the organisms that were found in the mud? Why is this? What kinds of food would they find in the mud? Why is this? Where does it come from? Do you think these organisms could live on a plant or on a rock? Why not?

What makes the organisms which live throughout the water different from the other ones that were found on the plants? What do you think they eat?

V. Large Aquatic Animals

An ideal tool for collecting small fish is the seine (minnow) net. If this is available for use, an excellent fish study could be undertaken. The net needs to be unrolled and placed across the stream with floats up and weights down, allowing it to take a U-shape. Bring the net towards the shore keeping the weighted bottom tight as it is lifted out of the water.

Fish, clayfish, and large beetles may be caught and can be transferred to a pail full of water. Identify and record observations. A fish's scales have observable ridges which can be counted as growth rings. Return all captured fish immediately after observations have been made.

The flat-bottomed nets are successful for collecting large specimens. Have the child sweep the net back and forth among water plants and along the bottom of the stream or pond. The child can also walk upstream for a distance with the net dragging behind him. The net is then pulled up and the contents transferred to a pail. Identify and record observations.

Have the child walk along the bank and look for any signs of animal life such as tracks and holes in the ground indicating a burrow. If the children anticipate viewing large animals such as racoons, muskrats, or turtles they may be disappointed. They will be very fortunate, if they do.

VI. Plant Life

Have the child examine plants from several distinct areas. Look for vegetation that is growing on submerged rocks and logs. Find plants that are floating or drifting in the water. Several species of plants that are rooted in the bottom mud and growing out of the water should be examined. Remind the youngster that plants may be pulled up with the roots but will have to be replanted. Observe the plants growing directly next to the water on shore, several metres away and then about 20 metres away. Identify and record.

Questions

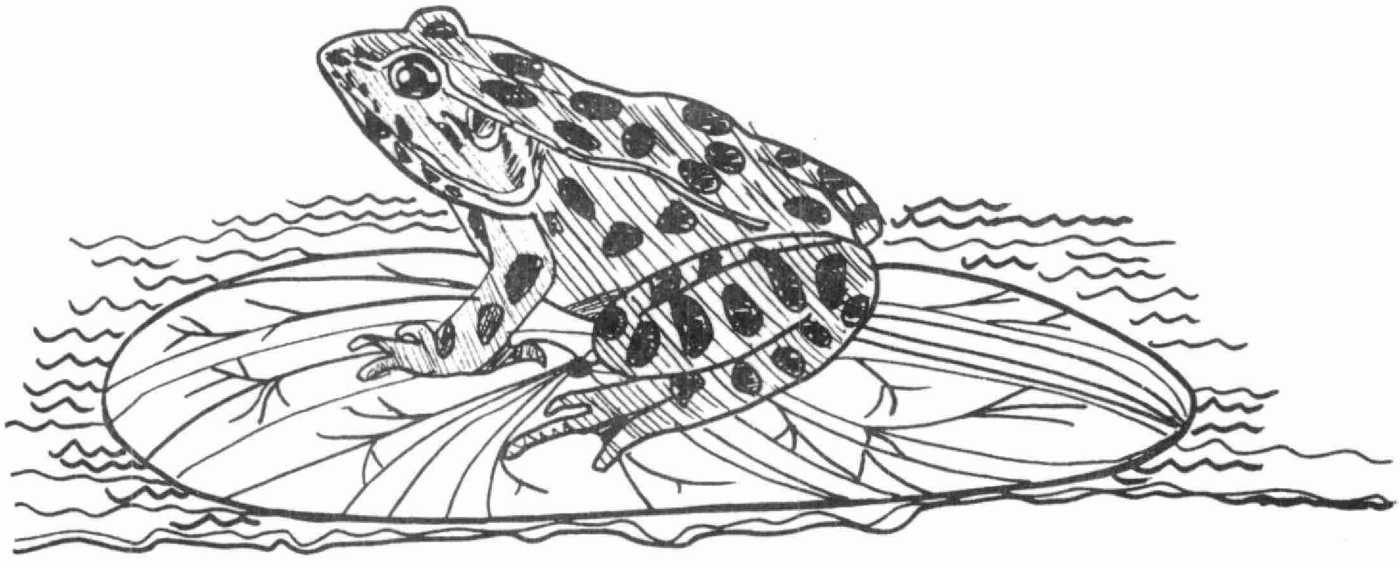
What differences are seen between the plants? How are the plants adapted to their particular area? Are they all the same color? Do they all feel the same? Do they look different when they are taken from the water? Could the plants taken from the water live on the land?

Additional Activities

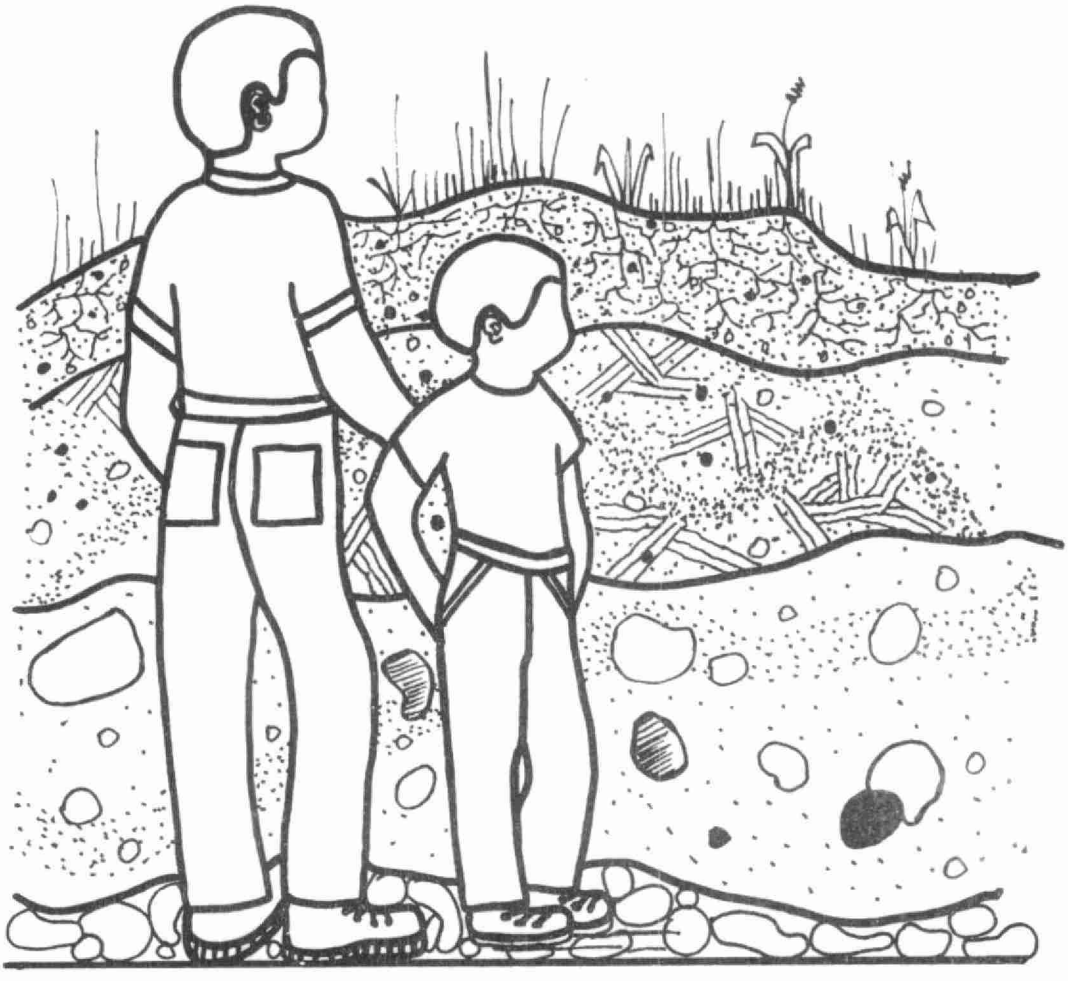
1. A closed ecosystem could be constructed. (Refer to the section entitled "Let's Build".)

2. A mural of the aquatic habitat could be drawn, painted, or constructed by the child.

3. A composition could be written on a typical day in the life of a plant or animal that was observed in the stream.



Digging Deeper: a soil study



Little children love to play in sand boxes and to dig holes in gardens or at the beach. They love the feel of the soil on their hands and arms but they rarely stop to take a good look at it.

As we get older, our direct association with the earth gets more distant -- unless we are trying to make a garden and wish to change the soil's productive properties.

However, an hour spent one day really digging into and examining the upper layer of our earth could be an interesting and educational experience for both you and your child.

This activity could be carried out around the home, at a campsite, or in a forested area.

Equipment:

- a watch with a second hand
- a measuring cup
- water
- an empty tin can -- remove top and punch six holes in the bottom
- a trowel or spoon for each of you
- newspaper
- magnifying lens

Activity I

1. Using your spoon or trowel collect samples of soil from various spots around the home (from under a tree, front yard and back yard, under a bush, near some flowers, etc.) or a nearby forested area. Place each sample on a different sheet of newspaper. A good sample size would be three or four handfuls. If you find some dead surface vegetation, such as leaves, take that along also.

2. Thoroughly examine each sample. Look for similarities and differences in the color, grain size, and smell. If you wish to find out the type of soil you are examining, fill out the soil comparison chart on page 58.

Things to Think About:

How is soil made? What causes rock to break down into soil? Can you see anything else in your samples that may eventually become soil? Why is soil so important?

Soil provides food and homes for plants and animals. If we know the soil type, we will also know what plants and animals we can expect to find in the area.

Note: A process, called *weathering*, causes rocks to break down into small soil particles. Weathering is the physical and chemical decomposition of materials by the elements. It includes such things as the action of rain or waves beating on rocks; the formation of ice in cracks widening them further; and, the breaking up of pavement, rocks, etc., by plant or tree roots.

Decaying leaves, wood, and animal matter, called *humus*, also make up our soil.

Although soil is made up primarily of two components -- rock and humus -- we do have different types of soil. This is because rock types may vary (for example, they could be sandstone or granite) and the types of humus can also change (leaves from deciduous trees form different types of humus, than do coniferous leaves).

The rock portion of the soil determines the color, grain size, texture of the soil. The smell and color are determined by the humus content.

Activity II

Another way to differentiate between soil types is to test the water *percolation* rate of the soil samples. In other words, by checking how long it takes water to ooze or trickle through the soil, you can see which types of soil are able to hold moisture better than others.

1. Fill the empty can half-full of soil. Hold the can at waist or shoulder height and pour three-quarters of a cup of water into the can.

2. Using the second hand of a watch, either you or your child should clock the time it takes from when the water is added to when the first droplets pass through the holes in the bottom of the can.

3. Repeat experiment with other samples and compare differences.

Note: Both the humus and rock content of the soil determines the percolation rate. A sample having very small particles and a large humus content will retain water more easily than will samples with large grain size and low humus content.

Things to Think About:

In the soil, you will most likely find plant roots and small animals. The roots anchor the plants growing above the surface and provide them with food (minerals from the soil) and water. Small animals move through the open spaces in the soil to find food, shelter, and water.

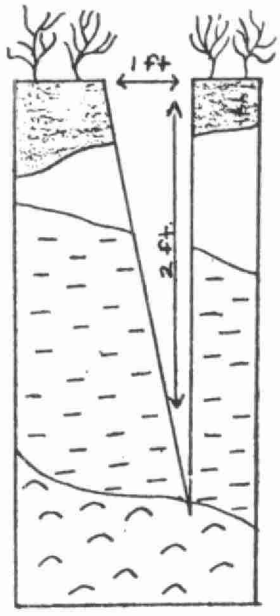
Do you think plants and animals could easily survive in soil which is entirely sand or entirely clay? Why or why not?

What happens when rain falls on the different types of soil? If the water does not run into the soil, or evaporates it back into the air, it may run off carrying soil particles with it. This is called *erosion*. How can you prevent erosion?

Activity III

On one of your walks, perhaps you have noticed a cut through a hillside where road construction or erosion is occurring. Closer observation of the cut surface may indicate layers of soil of different colors. The layers are known as *horizon* and all the horizons form a *soil profile*.

When digging a hole to plant a new tree, take a look at the soil profile.



A Typical Soil Profile

A Top soil layer, dark brown in color (several inches)

A2 Zone of leaching, light brown in color

B Zone of accumulation, reddish-brown in color (several inches - several feet)

C Parent material, grey brown in color

Take a good look at the color of the soil? Does it change its shade at all? Does the top layer feel the same as a layer deeper down? Do you see any roots? How far down do they go? Do you think all soil profiles look the same? Why not?

Note: The formation of soil horizons is caused by the movement of the plants and animals within the soil. They also add humus to soil. In addition, the finer particles of soil are carried down to lower levels by water.

Additional Activities:

1. Using cardboard, glue, various kinds of soil, twigs, leaves, etc., try to construct your own soil profile.

2. Build a compost bin (see section entitled "Let's Build") and examine the rate at which organic waste material is broken down.

SOIL COMPARISON CHART

CHARACTERISTIC	SAND	CLAY	LOAM
Soil sample site	_____	_____	_____
Color	light _____	medium _____	dark _____
Grain size	large _____	tiny _____	medium _____
Humus* content	slight (if any) _____	moderate _____	rich _____
Smell	none _____	foul _____	earthy/pine _____
When rolled through your fingers, it feels	rocky _____	dry: hard & plastic _____ wet: stiff & sticky _____	gritty _____
Speed of water flow allowed by the sample	straight through _____	allows very little, if any _____	moderate to slow _____

* Humus is the black or dark substance in soils formed by the decay of animal or plant matter that provides food for plant life.

Waste Watching

Have you ever gone for a walk and been amazed at the amount of paper scraps, bottles, and other rubbish you have found littering the pathway.

Many children and some adults are guilty of this thoughtless practice. They seem to think that the material will just disappear from sight.

Activity I

How about setting up the following experiment to show your child what happens to the litter he drops?

Equipment:

- large glass jar or bowl filled with moist dirt
- a metal barrette or paper clip
- a piece of plastic
- aluminum foil
- scraps of newspaper
- pieces of food -- orange skin, apple core

Arrange the objects on top of the earth and along the sides of the bowl so that they can be seen through the side.

Observe what happens to the objects over a period of time. Do they all disappear quickly? At the same rate? How does the container look? What would have been a more effective way of getting rid of the unwanted goods? Could any of those materials have been reused?

If your child and his playmates complain one day of having nothing to do, ask them to draw a map of their street or neighborhood. Then have them go out and mark every piece of litter they see on their map. What areas have the most litter? By the bus stop? At the corner? Near the candy store?

Perhaps you could help them write a letter to the Works Department of your municipality, or to the community newspaper requesting garbage cans in certain areas.

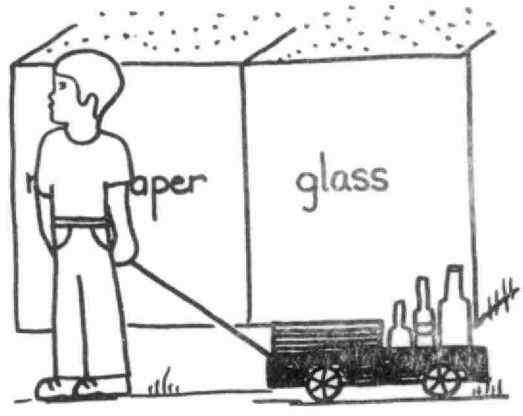
If the children have mapped different sides of the street, have them exchange maps, and by using the directions on their friends' paper, find and pick up the litter.

Activity II

On the average, every man, woman, and child in this country contributes four pounds of garbage a day to our disposal system.

In most areas, the garbage is hauled away once or twice a week by the municipality to some sort of disposal facility.

What's wrong with that? The problem is that many of the goods which we put into the garbage are made up of natural resources which could have been reclaimed or reused.



Secondly, many of the current waste disposal practices either bury or send our renewable and non-renewable resources up in smoke. In addition, we lose the use of valuable land either permanently or on a long-term basis when we bury garbage.

Why not investigate the type of disposal method used by your community. Phone your local municipality to find out what type of a site you have, how long it has been in use (if it is a sanitary landfill site, how much longer can it be used) and the location.

A *sanitary landfill site* is an area where garbage is dumped and then covered over with soil every few inches and every night. This helps to eliminate health hazards and to reduce the smell. When full, the site is landscaped and can be used for recreational purposes.

Use the experiment in Activity I to demonstrate what happens to the garbage that is disposed of in this manner.

In some communities, the garbage is taken to an incinerator where it is burned.

To simulate the action of an incinerator on garbage, carry out the following demonstration.

Equipment:

- aluminum pie plate
- paper
- rubber band
- piece of glass
- matches
- tongs

Using the tongs, hold the paper over the aluminum pie plate. Set fire to the paper. Observe what happens. Repeat using rubber band and then glass.

Is there anything left over? Was there any odour resulting from the burning? Was there any smoke? If so, what color? What do you think happens to the garbage that can't be burned?

Activity III

Yes, it would be nice if municipalities could adopt improved methods which would eliminate the problems mentioned earlier. However, plants such as the Ontario Government's Experimental Plant for Resource Recovery, which would incorporate separation and recovery processes leading to the resale of goods, are still in the experimental stages.

But there is something you and your family could do to cut down on the amount of garbage which your municipality is forced to cope with.

Practice the four R's of waste management -- reduce, reclaim, reuse, and recycle!

Why don't you and your child take a survey of the types of things your family puts in the garbage. What portion of your garbage is made up of paper? Glass? Tins? Food? Garden clippings?

Could you reuse any of the material you have thrown out? Could broken items be fixed? Could any of the unwanted materials, such as paper, tins, or glass, be taken to a recycling depot? Are there any returnable bottles in your garbage? Could you build a compost bin for the food wastes and garden clippings (see section entitled "Let's Build")?

Phone your local municipality to find out the location of your closest recycling depot and what sort of material it takes. (Old bottles and broken glass can be ground up and made into new glass. Aluminum cans can be melted and new cans made and new paper can be made from old.)

If you are really interested in seeing by how much you can reduce the volume of your household garbage, try this long-term investigation.

Before putting your bags of garbage out for curb collection weigh them. This can be done by standing on the bathroom scales, holding the bag. Then subtract your weight from the figure shown on the scale. Add the weight of all the bags together. Record them. To get an average figure, do this on two or three garbage days before you begin your home waste reduction program. (Incidentally, surprisingly enough, many children enjoy carrying out this mathematical activity.)

Then sit down with your child and discuss all the things you both feel you can do to reduce the amount of your household garbage. Write your plan on a big piece of paper and put it up where everyone can see it.

Once you have put your reduction plan into effect, weigh the bags of garbage that now end up on your curb. Compare the before and after figures. You should see a big change.

Discuss the effects of your actions with your child. Suggestions: You are putting out less garbage so your municipality doesn't have as much waste material to deal with. You are reducing the amount of garbage that is being buried so you are helping to save land. You have reduced the amount of material that must be incinerated so you are helping to reduce air pollution and odours.

Because you have taken materials to a recycling depot to be reclaimed we won't need to use up some of our natural resources to make completely new products.

If you would like additional information on waste management, write to the Information Services Branch, Ontario Ministry of the Environment, 135 St. Clair Avenue West, Toronto, Ontario M4V 1P5.

Some of the Ministry's pamphlets on waste are:

The Ratchford Experiment -- one family's attack on waste
The Ontario Centre for Resource Recovery
Who Cares About the Land?
About Resource Recovery
About Pollution -- Set 4
A Citizen's Handbook on Waste Management and Recycling

Buzzing Around: an insect study

STUDYING INSECTS AND THEIR RELATIVES

The close examination of insects is becoming more and more popular with children today and it is no wonder, since insects with their small, delicate sizes, bright colors, and fascinating habits, do make interesting study projects. Every child will have had some experience with insects as they are the most numerous creatures to be found anywhere. There are nearly one million species now known and up to 5,000 new species discovered each year.

This study aims to introduce children to living creatures. It does not encourage collecting of any kind or killing for permanent collections. Any insects that are collected should be returned to the location that they were found in, unharmed.

Although we have included some diagrams of insects in the identification section, a good identification book such as the "Golden Nature Guide" on insects is almost a must to help identify and classify the specimens found. However, even if a specimen is identified only to the extent of belonging to a certain insect group such as a grasshopper, termite, fly, beetle, bee, wasp, ant, aphid, mayfly, or as an insect relative such as a spider, centipede, or a millipede, this is sufficient. Avoid intensive identification studies which may become tedious.

Initially, children should be introduced to the various types of insects in the area, their homes, and how to catch and observe them. This may generate inquisitiveness and inspire them to undertake further investigations.

Insect studies may be carried out in any season. In summer, of course, the insects are more active but the winter is an ideal time to study insects with a powerful venom in comparative safety as they are quite sluggish when cold.

Insects are cold-blooded. This means that their bodies are not internally regulated to a constant temperature so that gradually they take on the temperature of their surroundings. To survive thermal changes, insects have adapted so that during cold periods they enter a resting phase, in which they cease their life activities and development. This stage is called *diapause*. A bright, sunny winter day may temporarily revive dormant insects. Check the south-facing sides of rocks and stone buildings.

Many adult insects hibernate under logs and rocks, in weed clumps, grass turfs, crevices, and among fallen litter.

Beetles, ants, wasps, and bees may be found in the wood of fallen trees.

Background Information

An insect is an animal with six jointed legs, a body made up of three sections (head, thorax, and abdomen) and a shell-like covering over the body (an exoskeleton) with no internal skeleton.

Reproduction: Almost all insects start their lives as tiny eggs laid on leaves, tree branches, or living animals; in flowers, plant stems, fruits, roots; in rotting carcasses; in the ground; or in water. They do, however, become adults in different ways. Some undergo four distinct changes in their development. This is called *complete metamorphosis*. Others have a more gradual development, which from beginning to end, changes greatly but in which each consecutive stage is only

slightly different from the preceding one. This is known as an *incomplete metamorphosis*.

Some insects which undergo a complete metamorphosis are moths, butterflies, beetles, wasps, ants, bees, and flies. These insects come out of their eggs as *larvas*. Larvas may be leaf-eating caterpillers, root-eating grubs, or maggots feeding on dead animal or plant matter. They spend all their time eating and growing. When they reach their maximum size, they turn into *pupas*, hiding in some plant part or in the unshed larval skin or in a cocoon. When the insect leaves this stage, it is called an adult.

Dragonflies and grasshoppers are among the insects which undergo a gradual transformation. They emerge from their eggs in the form of *nymphs*. Grasshoppers resemble the adults but have no wings. They shed their skins several times, becoming larger and slightly different with each molt. In the adult stage, the insect no longer molts; it is involved in reproducing.

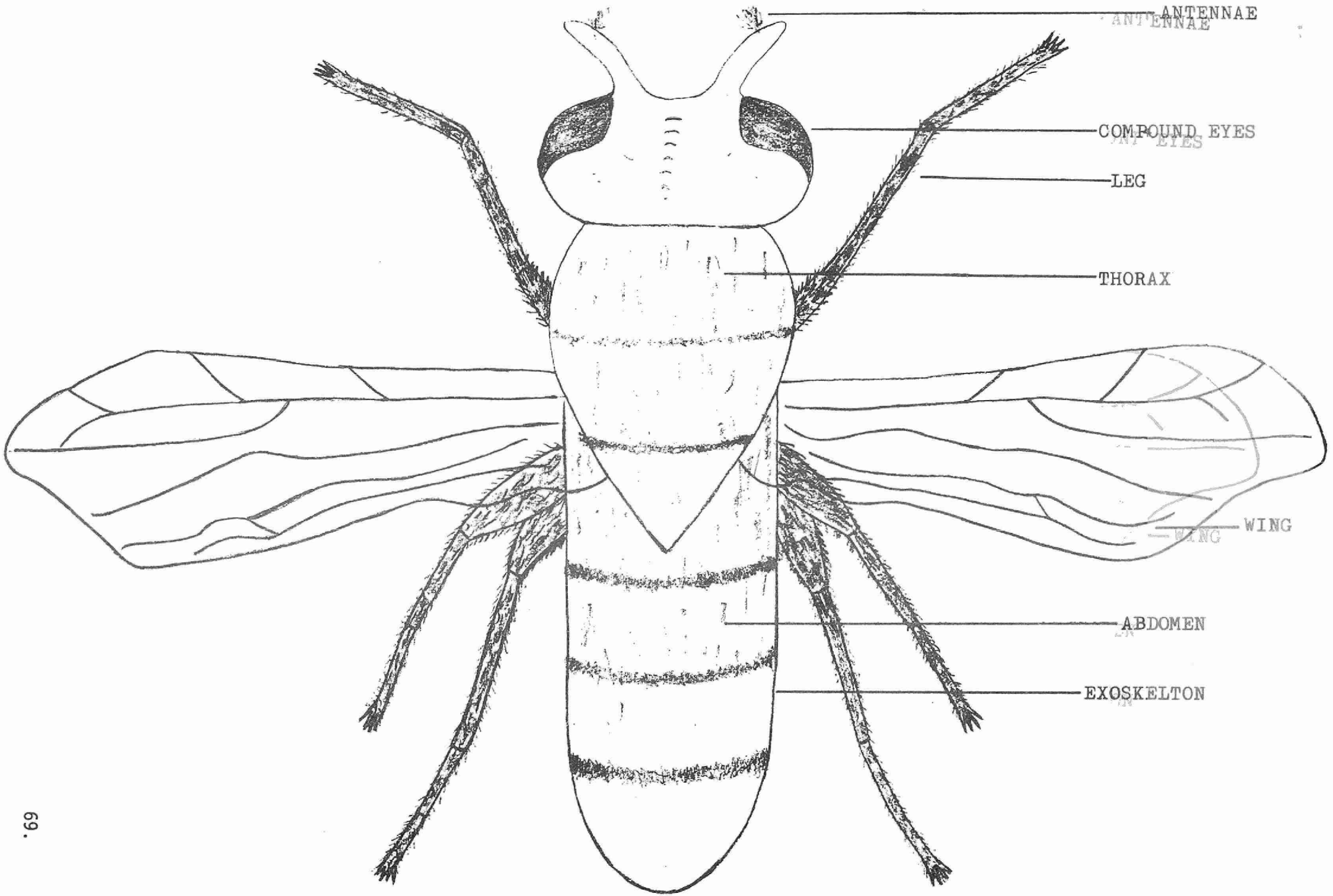
Seeing, Hearing, and Feeling: An adult insect has two compound eyes -- one on each side of its head. These compound eyes are made up of many tiny eyes set close together, like a honeycomb. The six-sided areas into which each compound eye is divided are known as facets. The compound eyes of ants and other insects that live on the ground have only a few facets, and their vision is not as sharp. The eyes of dragonflies and some other species may have thousands of facets.

Many species also have three simple eyes situated between the compound eyes. You will need a magnifying glass to find them, however.

Insects can perceive mass, motion, light, and color to a certain extent. Bees, for instance, see little of what we perceive but they can see beyond our spectrum and many plant colors are visible to them but invisible to us.

Hearing equipment is located in different parts of the body, according to the species. The grasshopper has an oval membrane sensitive to sound on the side of the first abdominal segment; crickets and ants have hearing organs in their front legs, and the male mosquito hears through its antennae.

Antennae are used to investigate surroundings and in many species are related in some degree to the sense of smell. They are attached to the head in front of or between the eyes. They vary in shape and degree of complexity according to the species.


ANTENNAE
COMPOUND EYES
LEG
THORAX
WING
ABDOMEN
EXOSKELTON

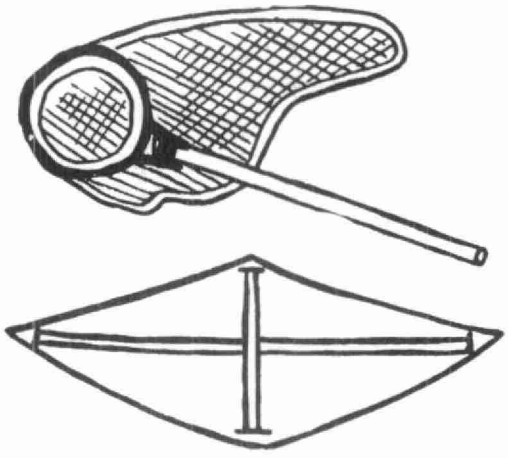
COLLECTING EQUIPMENT FOR SUMMER

1. In-ground traps:

- cans, soft drink, or soup cans with the top removed may be used.
- sugar, honey, jam, or similar sweet bait.
- rotting meat or a piece of fruit or similar solid bait.

Sink a tin can or similar container into the ground, placing either the sweet or solid bait inside. Cover the can with a rock or a piece of wood, allowing some air space to protect any captured specimen from the rain. Crawling insects such as beetles will be lured into the can.

2. Sweeping nets and beating cloths:



- coat hangers.
- fabric, old sheets, tea towels, or any cotton material.
- netting.
- wooden handle, broken hockey stick, broom handle (optional).
- umbrella (optional).
- wood, sticks are fine.

To make the collecting nets bend the coat hanger wire into a circular shape. Sew the cotton into a bag about 0.6 m long and 0.45 m wide and then sew it onto the wire frame. Do the same with the netting material. Attach the handle to the frame and bag with tape or wire. You may extend the wire from the frame and make it into a loop instead for use as a handle.

The cotton net is used to sweep through long grass and weeds to pick up the insects hiding there. The catch may be emptied into the specimen container to be observed and identified. The net made from mesh is used for collecting insects flying in the air such as butterflies and moths.

The beating cloth is used to catch insects as they fall out of trees and bushes which are gently knocked or shaken. An old sheet may be held under the tree by several children while another shakes the branches. A beating cloth may be made by attaching pieces of wood, sticks, or hanger wires to a piece of cotton that is about 1 m square in size. (See above diagram.)

3. Insect container:

- container, a 2.28 litre milk carton with the top cut off is ideal.
- mesh, wire screen.
- string, 1 m in length.

Attach the string to the container to form a carrying handle. The screen can be held over the top with elastic bands. Glass jars may also be used but are not recommended because of the possibility of breakage.

4. Field notebook: - a paper attached to a board or heavy cardboard with a pencil attached.

5. Magnifying lenses: (optional).

PROCEDURE GUIDELINES

A suitable location for an insect study is an open field of long grass and shrubs with a nearby woodlot. Begin the activity by demonstrating how to set up the in-ground traps, how to sweep the net back and forth through long grass, weeds, and shrubbery, how to hold the beating cloth under the trees, and how to gently knock, shake, and beat the branches.

The insects are then placed in the specimen container, observed, identified, and recorded in the field notebooks. If the children cannot identify something they have caught, a carefully drawn picture is advantageous. The in-ground traps are checked at the end of an hour.

Centipedes, millipedes, sowbugs, pillbugs, and some beetles may be discovered by looking in damp, dark places such as under large rocks, old boards and pieces of wood, and under leaves. An ant colony may be studied by watching the ants' behavior when bread or cookie crumbs are sprinkled nearby. Spiders may be found in shrubs, in the cracks of tree trunks, in the ground, or in dark places. How many different kinds of spider webs can be found? A spider may be hiding near its web under a leaf or branch so look carefully. In a woodlot the children can examine a 30 cm square of ground under the trees, quietly searching for the tiny insects that make their homes there.

Look for insect signs such as damaged or diseased plants, sticky substances on plants and insect homes such as galls, cocoons, mud nests, winding tunnels in rotting wood, in the ground, and also on leaves.

Stress quietness. The sound of our voices is as loud as thunder for nearby insects. Let's not scare them away.

SUGGESTED QUESTIONS

Flies: How many wings do you see? What color are they? How many legs does it have? Can you see its eyes? What color are they? What kind of noise is it making? Can you see its mouth?

Ladybird Beetles: Can it fly? How many spots does it have? Does it have the same number of spots as another one? How long are its legs? Where did you find it? What kind of plant was it on?

Butterflies: Are its wings smooth and shiny or fuzzy and rough? Where are its legs? How long is its body? How wide are the wings?

Leafhoppers: Are all its legs the same length? Why is this? How many different colors can you see on its body? What shape is its head? How far can it jump?

Carpenter Ants: How does it hold food and move at the same time? How many parts or divisions is the body composed of? Does it have feet? How long are the antennae? Does it have wings? Why not?

ADDITIONAL ACTIVITIES

1. Follow a crawling insect along the ground. What does it eat? Where is its home? How fast did it move?

2. Have a grasshopper race. Be careful when holding the insect in your hands. It does not enjoy being squeezed too hard.

3. Build a maze and put an ant in it. How long did it take to find the food? Try it several times. Did it take less time the second or third time?

4. Make an insect out of popsicle sticks. How is it adapted to its environment? (Wings: Mouth parts? Coloring?)

5. Look for insect homes on galls, plants, trees, on the ground, etc.

6. Discuss the ways in which insects are beneficial or harmful. Thought should be given to their importance in pollination; in producing food, such as honey; in controlling other insects (dragonflies eat mosquitoes) and weeds; and in providing food for other insects and birds. Equal thought should be given to their crop-destroying, disease-spreading, and nuisance characteristics.

Let's Build...

A PLANT PRESS

Take two sheets of hardboard or plywood about 45 cm x 30 cm and drill a few holes in the board to allow evaporation. Tie an old belt or strap around the boards to apply pressure.

Put some sheets of newspaper on the lower half of the press and cover with one or two sheets of blotting or other clean absorbent paper.

Arrange specimens as naturally as possible on this paper. Turn the leaves so that you see the upper surface of one and the lower surface of another. Textures are often important for identification.

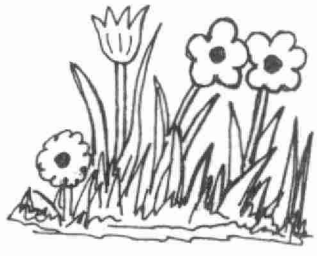
Cover with one or two sheets of absorbent paper. Add more newspaper. Replace the top of the press and tighten with the strap.

Leave in a warm room for a few days and then open up and replace paper, if necessary.

It usually takes about three weeks for the plant to dry, depending on the amount of moisture it contains.

Put the specimen in your collection. A loose-leaf folder makes a good storage place. Attach the specimens to the paper with small pieces of gummed paper.

Pressing flowers always distorts their shape. If you want to preserve them in their true form you can try drying them in a sand or borax bath (see "Arts and Crafts" section). They will lose most of their color but will retain much of their detail.



WAKE-UP GARDEN

Ever wonder how many living things are spending the winter under ground. Find out by making a wake-up garden.

Equipment: After a winter thaw, dig up some soil from the top of the ground, about 0.092 m^2 (one square foot) and 5 cm deep. Place the soil in a terrarium.

Terrarium: Two pieces of window glass 25 cm x 20 cm for the ends; two pieces 25 cm x 40 cm for the sides; and one piece 43 cm x 22 cm for the top. Tape the ends and sides together to make a glass rectangle. Shellac the taped cones to make them waterproof.

Spread freshly mixed plaster of paris over the bottom of a shallow pan measuring about 43 cm x 22 cm x 2 cm high. Set the terrarium into the pan and press it down firmly into the plaster. Allow the plaster to harden.

Put the soil into the terrarium. Place glass cover on top and set in good light. As the soil warms up, lots of little creatures that have been spending the winter under ground will begin to move about. You'll also see many little plants sprouting up from seeds that have been buried in the soil.

Empty the "garden" on some large sheets of newspaper and see how many little plants and animals you can count that were living in this 0.092 m^2 (one square foot) of soil.

Additional Activity: Use your terrarium to raise a miniature orchard. Wash thoroughly. Cover the bottom with clean gravel or bits of broken flower parts to provide good drainage.

Spread 7 cm (3 in.) layer of well-sifted sandy garden soil with some leaf mold added. Plant seeds in rows from your breakfast oranges, grapefruit, lemons, and apples. Try acorns.

A CRYSTAL GARDEN

You may not be able to work in your garden outside once winter comes but here is an exciting way to enjoy a beautiful indoor garden after the first snowfall.

Equipment:

- lump of coal (or broken brick, porous rock, or synthetic sponge)
- water
- glass container or bowl
- 4 tblsp. water
- 4 tblsp. liquid blueing
- 4 tblsp. household ammonia
- 4 tblsp. salt

Method:

1. Soak coal in water until thoroughly wet. (If using a sponge wring it out.) Place coal in bowl.
2. Combine 4 tblsp. of water, blueing, and ammonia and pour over coal, wetting entire area.
3. Sprinkle on salt.

Within a few hours, delicate crystals will begin to form, making unusual shapes. Your garden will last about two days. If you wish it to continue growing, add two tblsp. of water and two tblsp. of ammonia to the bowl every two days.

You can also add twigs, food coloring, and small rocks to your garden.

When you are finished working in your garden, place a glass bowl over the top to keep your creation from drying out and crumbling.

Note: Do not let crystals form over rim of the bowl as they can damage the finish on furniture.

SNOW SLIDES

Making slides of snow flakes is a very simple, fun activity for people of all ages. Bring them out on a hot summer's eve for a really refreshing view.

Equipment:

- projector slides
- cardboard
- hair spray
- slide projector

Method:

1. Store the slides and spray in the freezer until a snowfall.

2. Put the slides on a piece of cardboard and quickly move them outside before they have an opportunity to warm up.

3. Spray a thin coat of lacquer on slide and hold slide out in snow until several flakes have fallen on it.

4. Leave the slide outside in the cold for one hour away from falling snow.

5. When the slides are dry, bring them inside for viewing.

SIMPLE COMPOSTING OF DOMESTIC WASTE PRODUCTS

Composting is one means by which we can recover tangible benefit from our garbage and in so doing, reduce the volume of solid waste requiring disposal. It can become not only a hobby, but a beneficial and economical advantage to the home gardener.

The humus material from a compost heap has long been accepted as a soil additive and mulching agent which can be produced inexpensively in one's backyard. When added to the top soil, it improves texture, porosity, and water-holding capacity and increases the organic content of the soil.

HOW TO COMPOST

Generally speaking, composting involves taking organic waste material and placing it in a soil culture rich in natural organisms. The extent to which one gets involved in composting depends entirely upon the individual and the availability of the materials needed. However, this is a simple, inexpensive approach to constructing a compost heap:

LOCATION:

You can locate your compost heap in an inconspicuous corner of your yard or you can choose a central site and decorate it to suit your landscape. However, be sure that the spot is airy and sunny. If you are thinking about building a composting heap at your cottage or camp, be sure that it is away from waterways and wells and at least one foot above the water table.

CONSTRUCTION:

Home composting is best done in some form of enclosure. Choose a size convenient to your needs, whether it's a 3' square box or an enclosure 10' on a side. The pile can be as shallow as 1' or as deep as 5'.

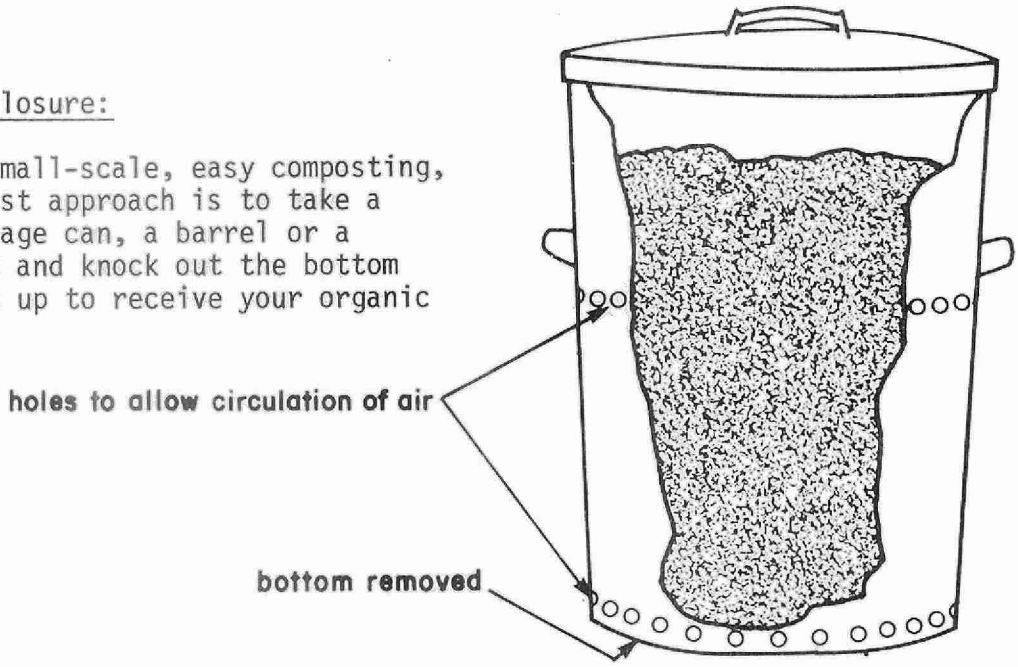
- Mark off a 4' square on the ground and dig a pit between 12" and 18" deep. The pit provides some warmth in winter months and keeps the compost damp in summer.

- Drive four stakes approximately 2" square by 2' long into the ground at the corners leaving 1' of the stake above ground.

- From a sheet (8' x 4') of quarter-inch aspenite plywood, cut four 1' x 4' rectangles and nail them to the stakes forming a 4' x 4' x 1' enclosure. Leave a small space, about 1", around the bottom so that air can circulate up through the heap. The remaining half of the sheet will be used as a cover for your heap during winter. In summer, a sheet of heavy gauge plastic placed on a 4' x 4' frame of 2" stock will be used as a cover. This will keep your compost heap from being a breeding ground for insects and will also help retain moisture.

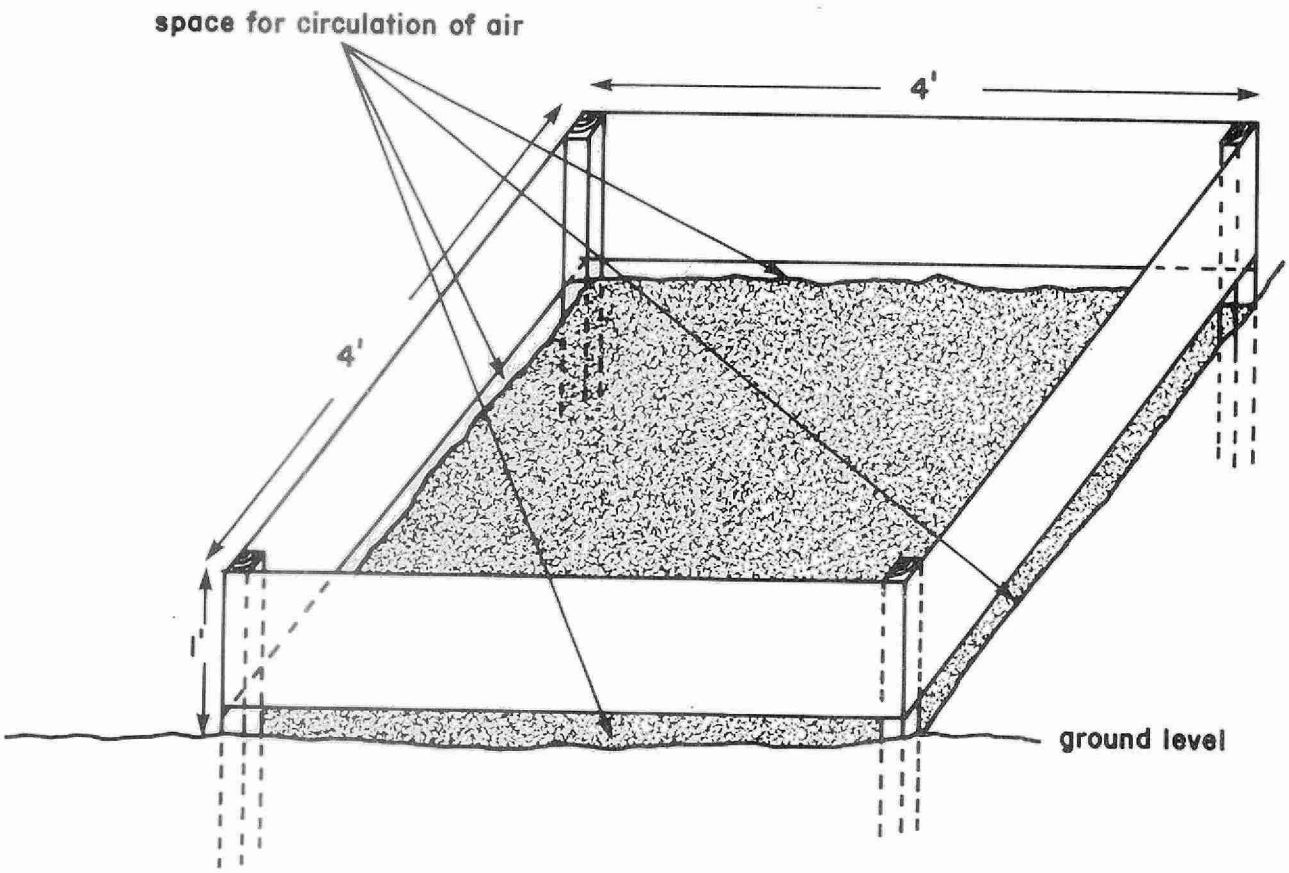
Simple enclosure:

For small-scale, easy composting, the simplest approach is to take a large garbage can, a barrel or a wooden box and knock out the bottom and set it up to receive your organic wastes.



Custom enclosure:

A composting enclosure can also be tailor-made in any size. These directions show how to build an enclosure four feet square rising one foot above ground level.



Your composting bin is now ready to receive your organic wastes.

COMPOSTING:

Many methods for adding waste material to compost heaps are used. The simplest is to add material as it becomes available. Be sure not to add thick layers of finely ground material such as sawdust. These materials will pack tight and prevent adequate circulation of air.

Another method is to arrange your compost heap into layers by placing a thin layer of a commercial starter (or fertilizer) between each 6" to 8" of garbage. The starter is used to increase the bacteria count and the fertilizer will increase the nutrient content of your pile.

Whichever method you choose, remember that for your compost heap to function adequately, it must be kept moist but not soggy. Every two or three weeks the pile should be turned. This mixes and aerates the raw compost.

While the garbage is decomposing, heat is produced. This heat should be contained by covering the pile. Heat keeps the natural organisms functioning effectively to decompose the waste.

After every turning of the heap, heat again builds up. When the heat production stops, your compost is ready to be used as low-grade fertilizer and soil conditioner.

WHAT TO COMPOST:

Organic wastes are the main source of material for a composting heap. These are everyday household ingredients which can be added to a compost heap:

Kitchen garbage	*sawdust
vegetable and fruit peelings	pet waste
coffee grounds	*newspaper
*egg shells	barbecue grill residues
*clam and oyster shells	straw and hay
peanut and nut shells	garden residues
leaves	grass clippings

*acceptable in small quantities

With a little time and effort, and a minimum of expense, you can successfully reclaim some of your kitchen wastes in compost and reduce, at least in part, some of your house's garbage problems.

SETTING UP A CLOSED AQUATIC ECOSYSTEM

At some stage during their childhood, youngsters usually want or are given a fish bowl or an aquarium. However, keeping it clean, feeding the fish, and finding a babysitter for your holiday period often becomes a burden, at least for the parents.

How about setting up a closed aquatic ecosystem? It provides the same visual attraction as an aquarium; once established, requires little or no maintenance; is relatively inexpensive to set up; and, most importantly, can provide an ideal educational experience for parents and children alike.

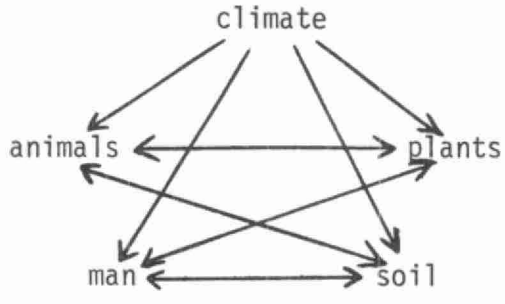
What is an *ecosystem*?

The term "ecosystem" is used to describe the many interactions of material and energy between living and non-living factors in the environment.

In other words, the term "ecosystem" is used to sum up all the influences and effects which the living part -- the plants and animals (the biotic community) -- have on themselves and on the non-living part -- the climate and soil (the abiotic components). The only ingredient necessary to start these interactions is the presence of energy in the form of light or heat.

Examples of ecosystems are lakes, ponds, forests, oceans, or the world.

In a diagram form, the ecosystem concept looks like this:



The closed aquatic ecosystem which we are discussing here is actually a picture of the world's ecosystem in miniature.

It consists of a glass jar filled with water, fish, snails, and plants located in the bottom sediment. Once the lid is in position, it is like the earth. Apart from the sun's rays that supply life-giving energy for plant growth, nothing else is able to enter or leave the jar (or the earth) to sustain life.

How do the animals breathe?

By filling the jar only three-quarters full of water, the remaining quarter is left for air. The amount of oxygen in the air and water is constantly being replenished by the green plants, which give off oxygen during the day when they

are manufacturing food for themselves. This food-making process is called *photosynthesis* and requires water, carbon dioxide, and the presence of sunlight. (The carbon dioxide is provided by the plants themselves during the night and by the animals, who give off carbon dioxide when they breathe in the oxygen.)

The plants are also known as producers as they provide the animals with food (their leaves) and oxygen.

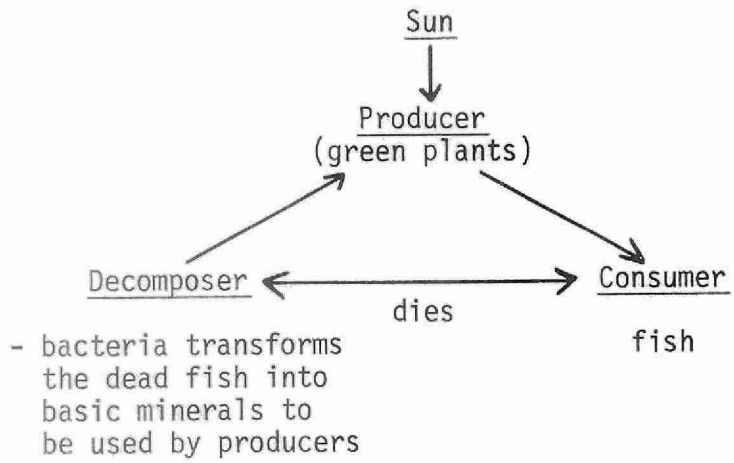
Incidently, at night when there is no light, the plants absorb oxygen and give off carbon dioxide.

Will the animals ever starve?

If the system is a balanced one, the snails and fish should never go hungry. There should always be enough plants for them. If however, their population becomes too large for the food supply, the weaker members will die off until their numbers are in proportion to the food available. The animals are called consumers because they use the oxygen produced by the plants and feed either directly on the green plants (these are the herbivores) or on the animals that feed on the plants (these are the carnivores).

Some animals play more than one role. The snails are consumers as well as decomposers.

Decomposers, such as snails, yeast, bacteria, and fungi (most decomposers are microscopic creatures) work to break down dead material and return it to the soil.



Does the water level in the bottle ever drop?

Over a 24-hour period, you may notice some very minor changes in the water level. However, in a closed ecosystem, as on earth, the water is always being recycled.

In the morning take a look at the sides of the jar, near the top. Do you see any water droplets? Check for the droplets again in the afternoon.

During the day, the heat of the sun raises the water temperature in the jar and some of the water changes to vapor and evaporates into the air -- like steam from a bath. Overnight, when the vapor cools down, it condenses and turns back into water. In a natural setting, it would return as rain, or, if it is very cold, as ice.

This constant movement of water into the air and then back to earth again is called the *hydrologic cycle*.

I EQUIPMENT

A. A Large Bottle
B. Aquatic Plants (Algae)
C. Bottom Sediments
D. Stopper or Lid
E. Rubber Gloves (Optional)
F. Kitchen Sieve
G. Plastic Bag and Guppies

II CONSTRUCTION OF AN ECOSYSTEM

1) Obtain as large a bottle as possible (preferably one with a lid, or one that can be stoppered). One which holds four to six gallons is ideal.

2) Clean the bottle thoroughly.

3) Visit either a slow-flowing stream or, preferably, a pond or lakeshore. A site where aquatic plants are growing will probably yield a variety of aquatic life, both plant and animal.

4) Scoop approximately two to three inches of bottom sediment into the bottle. If there are aquatic plants (especially algae) at the site, obtain a portion of these. (A kitchen sieve will act as a net to catch tiny aquatic organisms that might live amongst the aquatic plants.)

5) Fill the bottle three-quarters full with water obtained at the site.

6) Return home with the bottle and place it on a window ledge (preferably a south-facing window) where sun will shine on it at some time in the day. Allow the contents to settle overnight.

7) If aquatic plants could not be obtained from the collection site, a visit to a local tropical fish store will be necessary. Purchase a few strands of an aquatic plant such as Canada Water Weed (elodea). If you haven't obtained some snails in your original sample, then it might be

wise to purchase some of them as well. If you want fish in your ecosystem, three or four small guppies might be purchased. (Remember, the guppies will eat some of the other life.)

8) Carefully insert the aquatic plants into the bottle and secure them in the bottom sediment (if necessary by tying them to a weight such as a stone).

9) If guppies are added to the system, they should first be placed in a plastic bag. The bag and contents should be placed in the ecosystem so that the water temperature in the bag has a chance to gradually become the same as the water in the ecosystem. This is necessary or the fish might suffer from temperature shock and die. After several hours, release the fish from the bag into the larger container.

10) Place a lid on the bottle, but don't seal it.

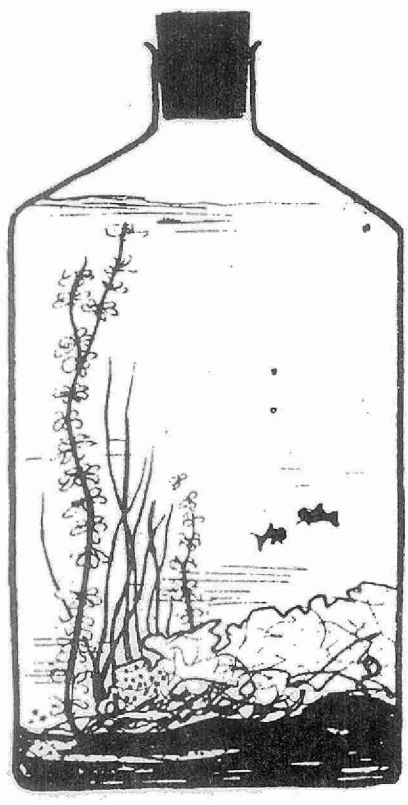
11) Observe very closely for the first few weeks. A green hue will indicate healthy algae blooms which the fish need for food. If fish gasp at the top for air, add more plants. Try not to disturb the bottom sediment.

12) After a few weeks, when the system is functioning and appears to be in some sort of balance, the bottle can be sealed by melting some parafin wax and applying it around the lid or stopper so that no air can enter or leave.

III OTHER THINGS TO CONSIDER

1) If time is not a factor (and it shouldn't be), allow the system to adjust to the light source for several weeks before adding guppies.

2) If space and time is available, set up some experiments, using other bottles to illustrate various ecosystems. For example, you can add or subtract components of the system. More guppies can be added to a second bottle, or sediment might be excluded from a third bottle. Using the one ecosystem as a control, it is possible to see how each of the various components are important to the 'balance' that eventually is established.



CONSTRUCTION OF A TERRARIUM

Terrariums have brought joy to people for nearly one hundred years, ever since a Dr. Ward of England, noted that plants kept growing under tightly sealed glass. Have you considered why plants are able to grow in the sealed container? Why light is required by plants? Why an animal can remain alive in a terrarium but quickly suffocates in an empty sealed container? The terrarium you construct is a model of a terrestrial ecosystem, enabling you and your child to witness the interactions that occur between plants, animals, and the non-living environment to maintain a balance between themselves. Your child will come to realize, by observing this closed environment, that things constantly change. (For a more detailed explanation of an ecosystem see "Setting Up A Closed Aquatic Ecosystem".)

BUILDING THE TERRARIUM*:

You and your child can make a terrarium in anything from a baby food jar to an aquarium (even a leaky one). The principles are the same. The materials you need are:

1. A container that light rays can penetrate
2. Gravel or sand
3. Charcoal
4. Soil with some humus (decayed plant material)
5. Small plants and tree seedlings (dig up soil with the roots). Mosses, ferns, violets are fine. Keep in a plastic bag until ready for use
6. Small saucer of water
7. A pretty rock or two
8. Plastic wrap or glass to cover the terrarium
9. A few grass seeds
10. A small thermometer to keep in a corner of the terrarium
11. Animals: a snail or slug, bugs, beetles, frog, toad, ant, grasshopper, snake, or caterpillars

Putting it Together:

1. First, put in a one- to two-inch layer of gravel for the excess water to drain down into.

2. Then add small pieces of charcoal to the soil. Charcoal is burned wood with lots of air spaces and its addition will keep the soil well aerated and will absorb gases. To use commercial charcoal briquets effectively, break them into small pieces to increase aeration. Better yet, if the briquets are burned, the alkalinity or "sweetness" of the soil increases. For greater effectiveness, add burned wood ashes. This will improve both the physical and chemical structure of the soil.

   (An alkaline or "sweet" soil contains more elements of calcium, potassium, and some compounds such as lime. Some plants thrive better in "sweet" rather than in "sour" soil.)

3. Add two to three inches of topsoil. Don't use playground clay, but soil from under bushes, along fences, or in other areas where some humus has accumulated.

4. Add a small water dish to serve as a pond for animals to drink from and to supply a good humid environment.

5. Add the plants. Space the plants to allow room for growth. You may also want the children to plant a *few* seeds or nuts.

6. Add the animals. Do not put large animals in -- no mammals. A snake or toad needs room; snails, worms, and ants need less room.

7. Place the terrarium near a window but do not let the sun shine directly on the terrarium or you will have an oven instead of a terrarium. Do not set the terrarium on a radiator or other heat sources.

MAINTENANCE:

If the terrarium seems dry and a "rain" doesn't fall from the top of the container, sprinkle a little more water in. If mold is forming, it is too wet. Leave the top off for a day, or leave a slight space in the top covering. Dead plants or animals should be left to illustrate the recycling of material.

The children may respond with a request for more animals than the terrarium can handle. Keep the number and size of the animals limited. Too many slugs can defoliate your terrarium and a medium-sized turtle can trample it. You may have to be selective.

The terrarium can self-support a limited supply of plant-eating animals, and probably only one meat-eating animal. For instance, several grasshoppers will eat the plants and, in turn, be the food for a single toad.

The purpose of limiting the supply of animals to a closed terrarium is to demonstrate how soil, plants, and animals, *thriving within the confines* of the container, depend upon the life and death of each other. The terrarium plants and animals may exist totally independent of any outside forces. This is representative of a closed system. The mini-world in your terrarium is self-supporting.

If you have more animals than the terrarium can hold, you will have to supplement their food. Soft fruit and leafy material for those that eat plants and live worms and insects for the meat eaters will be necessary. A reminder: to use supplemented foods in the terrarium alters the relationships among the soil, plants, and animals. This kind of terrarium would demonstrate a less "closed" system.

ADDITIONAL ACTIVITIES:

1) To demonstrate the importance of sunlight to plants place one plant in a dark cupboard while leaving a second plant in the light. Observe the changes in the plants' appearance daily. The plant in the dark will wilt, lose color, and eventually die because it cannot produce food without light.

2) Construct a food chain mobile using the plants and animals in your terrarium. Start with the word "sunlight" at the top of your chain. What other things do plants need to grow so they may feed the animals?

3) Over a period of time, many changes occur in the terrarium. Each day the terrarium's physical environment changes; in addition, all of the living things in the terrarium undergo change. The child should look for changes and record them.

   Types of changes you might look for:

   Plants: seeds sprouting, seedlings growing, flowers developing, fruits, plants decaying, mold forming.

   Animals: reproducing, dying, moving, shedding skin.

   Other: temperature changes, water recycling-evaporation of the water as the temperature rises in the afternoon and condensation occurring overnight on the sides of the jar as a result of cooler temperatures.

4) Compare changes in the backyard to changes in the terrarium.

"Building the Terrarium" section is reprinted with permission of the Ohio Department of Education and the Willoughby-Eastlake School District.

Arts and Crafts

Here are some activities to give children active participation, appreciation, and a knowledge about the world in which they live.

FOR YOUNG CHILDREN

Leaf Tree

Draw a large picture of a tree with bare branches on poster board. Have children collect colored leaves to add to the branches. (Leaves will last longer if ironed between two pieces of waxed paper.) As the seasons change, remove the leaves and add snowflakes, then blossoms, green leaves, bird nests, and birds.

Treasure Tote Bag

Take two pieces of construction paper (20 cm x 25 cm) and staple three sides together to make a pocket. Make a handle from a long strip of construction paper.

Have each child decorate his bag with drawings of leaves, trees, or flowers.

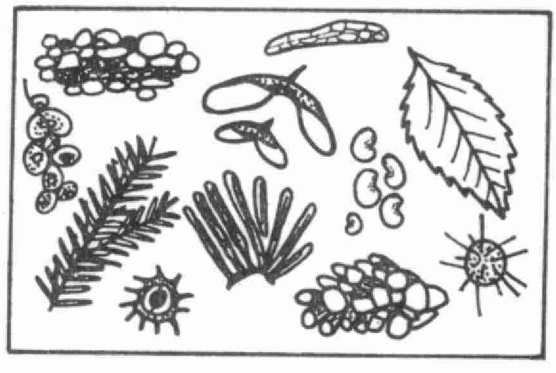
Use the tote bag for leaf walks or treasure hunts. Upon returning from a leaf walk, have children examine the leaves. Discuss colors. Use the leaves for activities involving classifying (for example, piles of small, medium, and large) and for counting.

My Touch-Me Book

Use poster board for cover and construction paper for inside pages. On each page, paste various materials from nature which provide various sensory experiences.

For example:

page 1 - milk weed pod seeds (soft)
page 2 - bark of tree (rough)
page 3 - large seeds (bumpy)
page 4 - seed from burdock (prickly)
page 5 - leaf (smooth)
page 6 - soil (gritty)
page 7 - maple keys (wrinkly)
page 8 - stone (hard)



Punch holes in your book and tie together with yarn.

Flannel Board

Make a flannel board from plywood or heavy cardboard 90 cm x 1.5 m. Over this tightly stretch a piece of flannel. Fold flannel over the edges and fasten securely to the back with thumb tacks. With colored crayons draw a picture on the flannel or cut out pictures from colored construction paper (which will stick easily to the flannel). Change your pictures on the board to match the seasons.

Mobiles

Create mobiles by cutting out different nature photos from magazines or by drawing pictures yourself. Paste them onto cardboard. Using different lengths of string, tie them to pieces of wire or a coat hanger. Can also be used with older children to depict food chain and web.

FOR THE OLDER CHILD

Spore Printing

Spore plants, such as mushrooms and toadstools, multiply themselves by shedding a fine powder made up of particles called spores. These spores produce the new plant.

Place the head of a toadstool or mushroom, underside down, on a white sheet of paper and keep it in a dry place overnight. In the morning you will find that spores will have fallen on the paper and formed a pattern called a spore print.

Alternative: Apply a thin coat of a half-mucilage-half-water mixture (or a slightly beaten egg white) to a sheet of thin cardboard. Leave the mushroom, underside down, on it overnight.

Leaf Prints

Pin pressed leaves or ferns on drawing paper. Spatter paint on paper by scrapping a toothbrush dipped in paint or ink across a screen. Remove leaves when ink is completely dry.

Alternative: Apply ink to back of dried leaf with a roller. Carefully press a sheet of paper over inked leaf.

Alternative: Lay leaf, vein side down, in ink pad. Cover with fresh scrap of paper, rub hard. Transfer leaf, ink side down, to white paper. Cover with fresh scrap of paper. Rub hard being careful not to move leaf.

Sand Casting

Put sand in a box large enough to hold object which is to be cast plus a border along all sides. Dampen sand so the grains will stick together. Draw or carve design in sand or sink object to be moulded. In a separate container, stir equal amounts of water and plaster of paris until mixture thickens. Pour plaster into depression, filling deepest areas first. If you are making a plaque, place a twisted wire in the back to make a wall hanger. Remove plaster when hardened (approximately one hour). Some sand will stick to the plaster. It may be left for texture or may be removed with a brush. Design may be painted.

Rubbings

Cover leaf, fern, bark, twig, etc., with a thin piece of paper. Hold the paper with one hand, and with the other, rub a crayon gently over the paper. When you have finished you will have a detailed print of your piece of nature.

Sun Prints

Pin one or more leaves to a piece of colored construction paper, and put the paper in bright sunshine. After an hour or so, remove the leaves and you will have their outlines.

Soil Painting

Collect various types and colors of soil. Now sketch a picture on a piece of cardboard and apply glue where you want one type of soil. Sprinkle on soil. Brush glue on another area of picture, not too close to the already drying area, and add new soil. Continue until scene is complete. When soil is completely dried, stand the picture on a side and the loose particles will fall off.

Alternative: Mix soil with plaster of paris and apply immediately. Soil will dry lighter than it goes on.

Table Mats

Place several leaves and colored threads or small ferns between two sheets of wax paper. Press with a warm iron to seal paper together. Use scissors to scallop edges.

Plaster Casting of Bark

Squeeze and roll a half pound of plasticene until it is soft and flexible. Apply it to the bark area that you want to record. Work the plasticene thoroughly into the cracks and crevices. Carefully peel plasticene from bark so that it remains whole. Coat with vaseline.

Make a collar out of two-inch high cardboard and place it around plasticene mould.

Mix plaster of paris with water until mixture is the thickness of glue and has no solid lumps. Before it hardens, pour plaster of paris into the mould. Tap sides of collar to allow air bubbles to rise to surface. Insert paper clip so that cast can be hung on wall when it is dry.

When cast is hard, remove collar and mould; clean vaseline from impression.

To make cast even harder, boil it for a few minutes in a solution of one tblsp. borax to one pint water.

Try to paint your cast the same color shades as your tree (tempera paint is ideal).

Layered Transparencies

To decorate greeting cards, booklets, etc. Find leaves, feathers, grasses, ferns, etcs. (Some may need to be pressed flat.) Lay specimen or arrangement on waxed paper. Cover with a single layer of facial tissue (separate it) or rice paper. Mix white glue with water, half and half. Use stiff brush to go over surface and evenly saturate tissue with glue. Allow to dry. Iron between brown paper at "silk" setting. Trim with scissors.

Preserving Specimens

To preserve colored autumn leaves or flower blossoms or other plant specimens for a collection or a dried bouquet, try one of these methods.

(a) Sand Box

Collect leaves, flowers, etc. Remove leaves from flower stems. Put some sand in the bottom of a box. Make layers with specimens and sand. Put the box in a very warm, dry spot for a week.

(b) Borax

Put layer of borax crystals in a shoe box. Layer specimens and borax so that samples do not touch. Cover so none stick out. Put lid on box and put away for a few weeks. A plastic bag around the box will keep out moist air. Allow three weeks for leaves and four weeks for flowers.

(c) Plant Press

See section "Let's Build".

Wall Hangings

(a) Burlap

Pull out cross strands and weave in materials of your own choice -- vines, feathers, moss, bark, etc. Glue, tack, or staple ends to a branch or stick. Attach cord for hanging. Fringe sides.

(b) Plaque

Glue or sew grasses, flowers, seeds, bark, pine cones, shells, or any other natural items on burlap or on a board for a plaque.

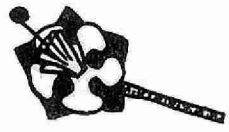
Maxi-Flower Models (see flower diagram page 40)

1. Wind some green florists tape around a length of wire. Coat hanger wire will do.

2. Cut a whorl of sepals. Look to see how many points you should have. These are usually green, but not always. Thread on your wire.

3. Cut out a whorl of petals. There may be more than one. Choose the correct color or colors. Thread this onto your wire also.

4. Find out how the stamens grow in your plant. How many are there? Cut a strip of material into a fringe, with the correct number of stamens. Wrap this around the wire. Spread the stamens as they should be.

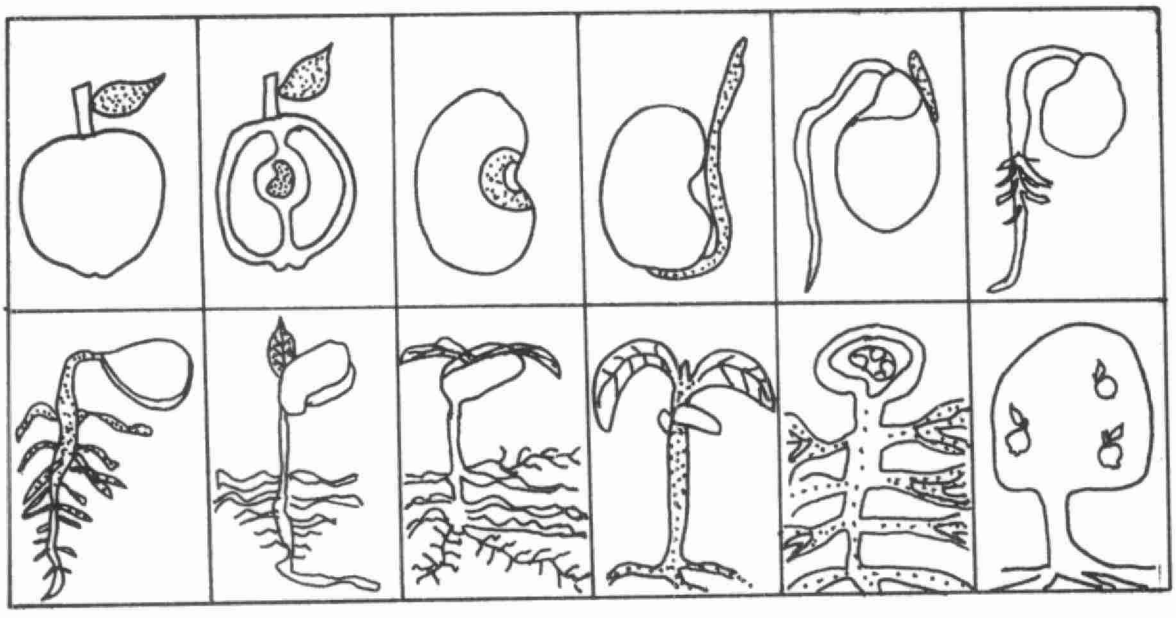


5. Examine the pistil of your plant. How long is it? Does it divide? Has it a knob on the tip?

Inventing Your Own Plant or Animal

Using items such as cotton, ballons, string, paper, glue, tape, perfumes, pipe cleaners, and potatoes, create an animal or plant for a particular environment.

Note: It is important that the child has a good idea about where his plant or animal will live. For example, a lawn plant has to survive a lawn mower and a desert plant has to be able to conserve water. Think about communication and protection also. How does a moth find a flower at night? How does a skunk protect himself?



CRAFT IDEAS USING NATURAL MATERIALS

MATERIALS	PROCESS	USE
driftwood	leave in natural state or rub it down with oil or wax	decoration, jewellery, mobiles, totem poles
twigs & branches	whittling and carving	furniture, birdhouses, whisk, brooms, spoons, forks, nametags, pins
bark	soak in hot water to make it pliable	bookmarks, hatbands, pocketbooks, whistles
nuts	clean with wire brush, sandpaper and wax, oil or shellac	bracelets, brooches, earrings, label pixies
pine needles		brooms, pillows
pine cones		animals, mobiles, birdfeeders, dolls, collages
berries		use juice for dyeing or staining
fungi	dry and then shellac to preserve	name plaques, shelves
mosses		pictures
seeds		bean bags, jewellery, rhythm instruments, collages, signs
sand		painting

DYEING

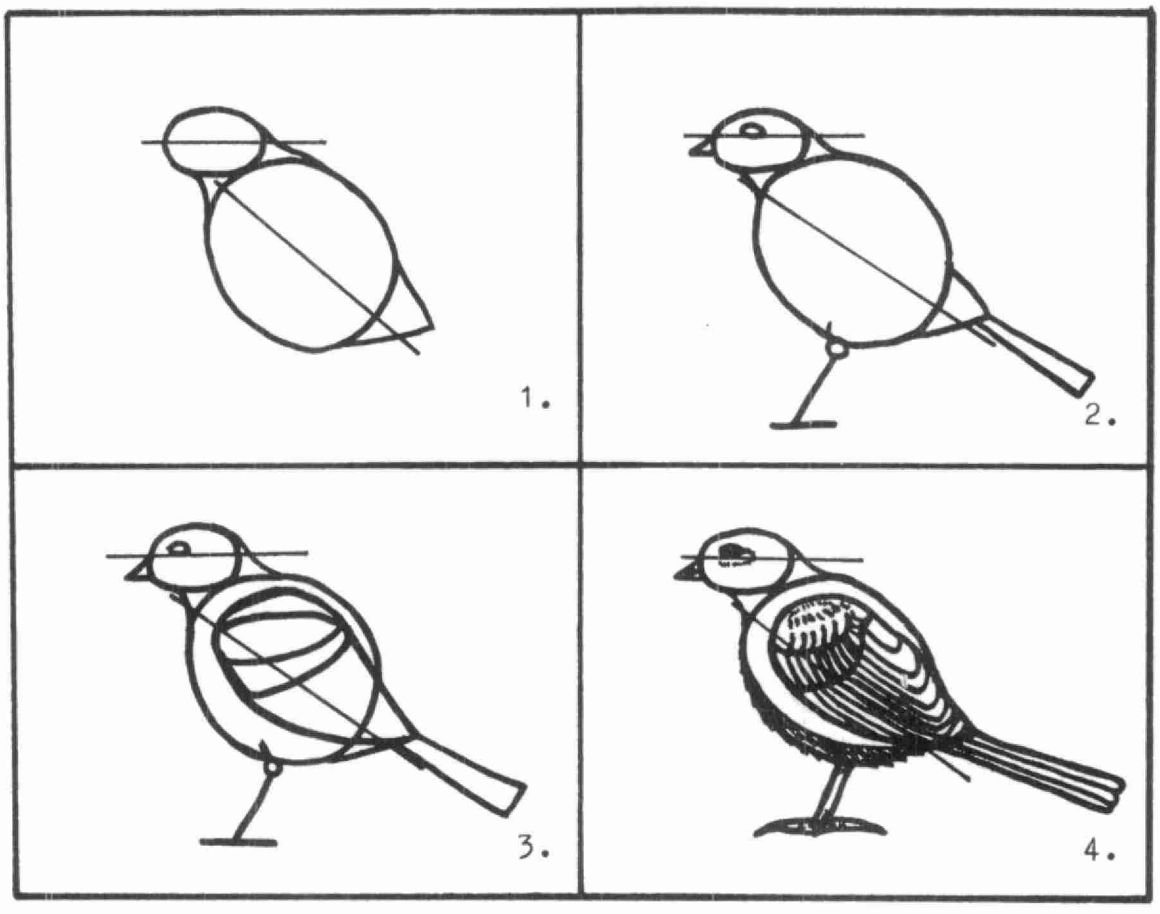
raspberries	dark red	onion skins	red or yellow
strawberries	red	bark	brown
goldenrod	yellow	dandelion roots	magenta
blackberries	blue	moss	light green

To prepare dye:

Cut the dye ingredient into small pieces and pound. Place ingredient in pot and cover with 7 cm of water. (The more water you use, the lighter the color will become.) Boil for one hour. Strain fluid.

To dye cloth:

Place dye in pot and add material. (Dye solution should cover material.) Boil for one hour. Add two tblsp. salt. Boil another 15 minutes. Remove cloth from dye and rinse in cold water. Hang out to dry.



Drawing a Bird (see also page 131)

1. Draw the basic body shapes -- an oval for the head, a larger one for the body, and a tail shape.

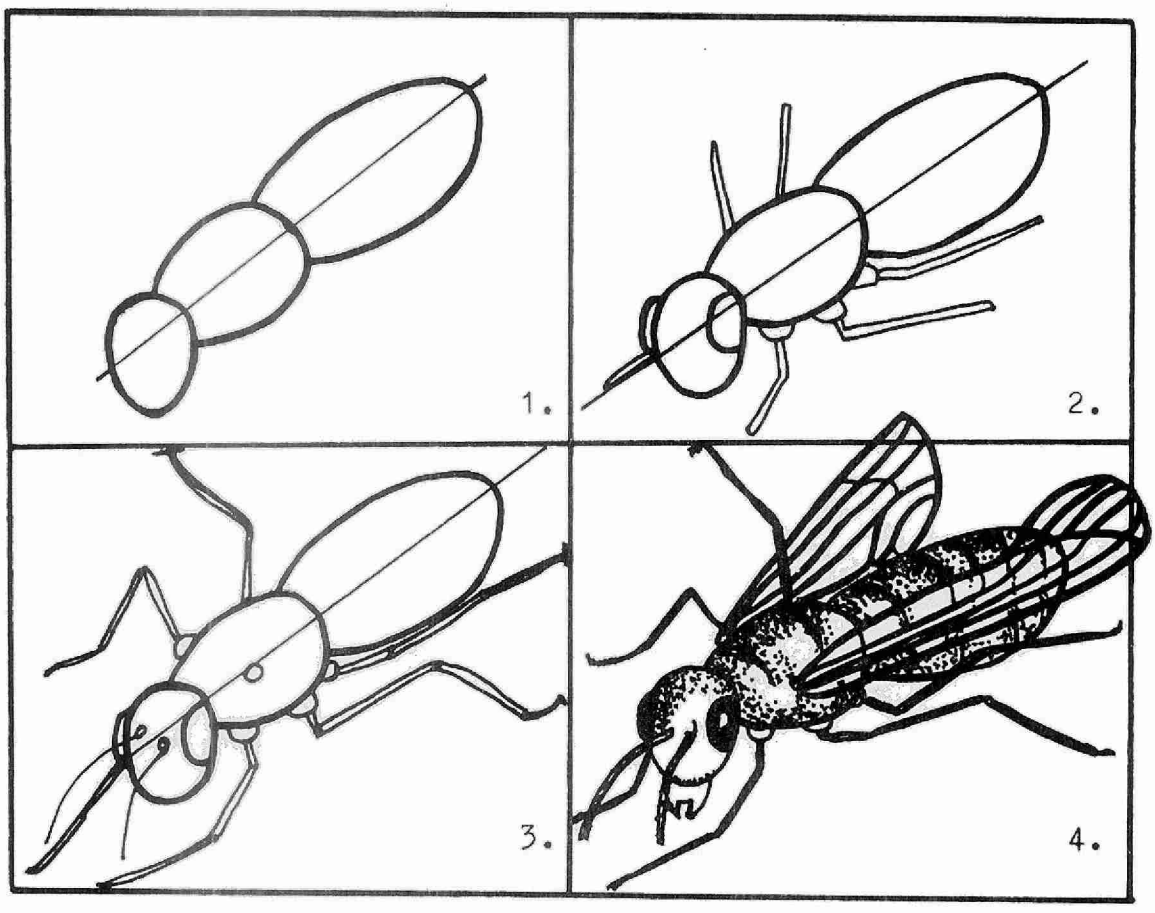
2. Add the eye, beak, leg/foot (indicating the leg joint) and the tail feathers.

3. Sketch in the main shapes of the wing feathers.

4. Look carefully at the bird and note its special features to complete your drawing.

Drawing an Insect (see also page 69.)

1. Use ovals to represent the head, thorax, and abdomen, lining them up as shown.
2. Add the first parts of the legs, noting where they join the thorax.
3. Complete the legs and add the antennae.
4. Draw in the wings and add modelling to make drawing lifelike.

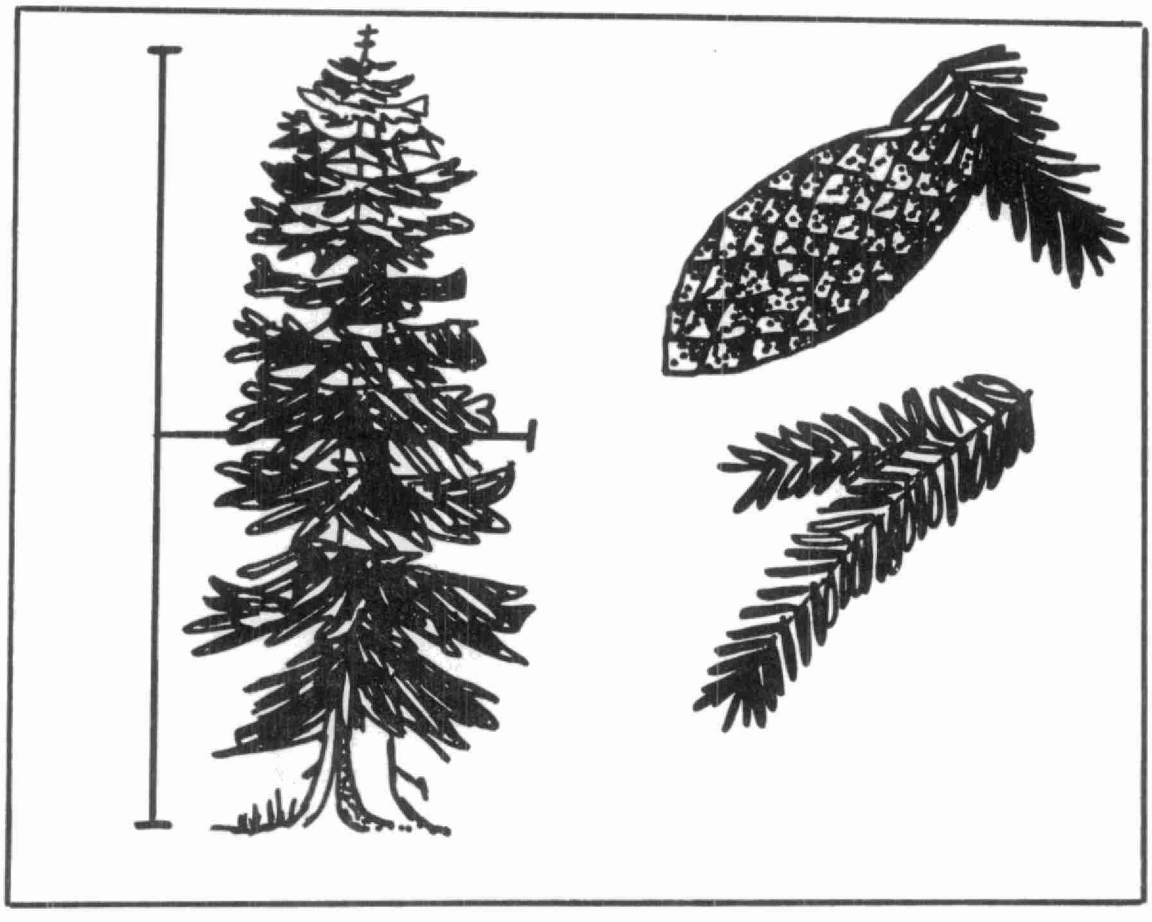


Drawing a Tree

1. Make sure you put the main branches in the correct position and record the date of your drawing, since the shape of the tree may change during the year.

2. Draw a leaf on the same page either in outline or in detail.

3. Draw a flower if the tree has them, and make sure you note the number of petals and the arrangement of the various flower parts (see page 40).



Identification Guides

AQUATIC INSECTS

1. May Flies (Ephemerotera)

May flies are abundant in streams and lakes and can be found in practically all fresh water throughout the Province. The nymphs are found on the undersides of rocks or other underwater objects. They have two or three tails. The wings of the adult are held in an upright position while resting.

2. Dragonfly (Odonata)

They are found in all types of fresh-water areas; ponds, lakes, streams, and swampy areas. The nymphs can be found crawling about on the bottom, on aquatic plants, or other underwater objects. They are one of the largest aquatic insects; most of them are dark brown to greenish as juveniles, change to brighter colors as adults. When resting, their four wings are held outstretched.

3. Stone Fly (Plecoptera)

Stone flies seem to require running water in which to live. They are never found in lakes except in the inlets and outlets. When the adult is resting its wings lie lengthwise upon the back. Nymphs are found in abundance only among the rocks in streams. Stone fly nymphs have two long and stiff tails.

4. Water Boatman (Hemiptera)

Boatmen are found in nearly all waters. They swim in an erratic pattern underwater, and usually found in slow moving waters. Boatmen are normally brownish in color and equipped with leathery wings.

5. Water Strider (Hemiptera)

Water striders are a familiar sight on the surface of slow moving waters, ponds, and lakes. They resemble long legged spiders. Although equipped with wings, they are rarely observed in flight. Their color is usually brown to gray. Many persons call them "water skippers".

6. Caddis Fly (Trichoptera)

Caddis flies are found in nearly all lakes, streams, and ponds. During their underwater life, they live in cases made from sticks and small particles of rock. These can usually be seen moving about on the bottom. When the adults are at rest the wings are held roof-like over the body and sloping down at the sides. The adults are generally dull brown or black in color. Sometimes the larvae are called "penny winkles" by fishermen. "Periwinkle" is another common name.

AQUATIC INSECTS

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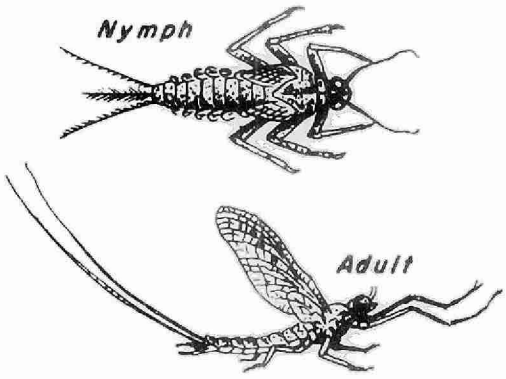
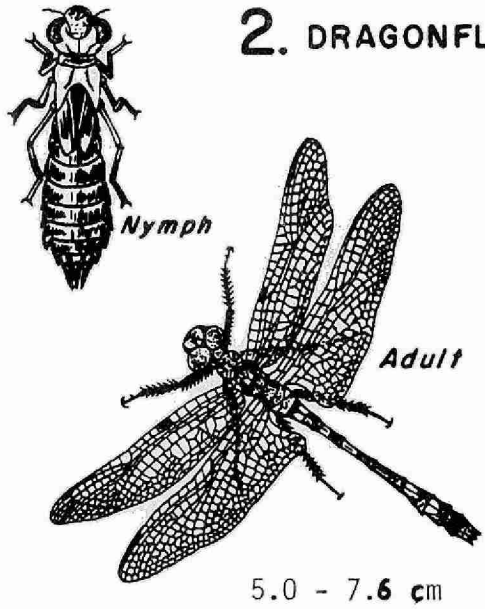
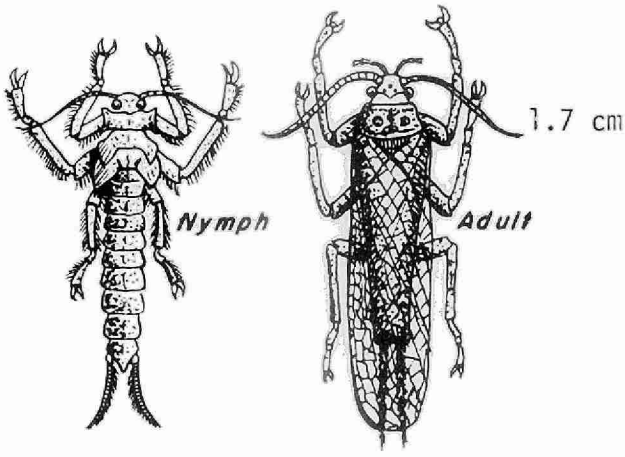


1. MAYFLY 2.8 cm

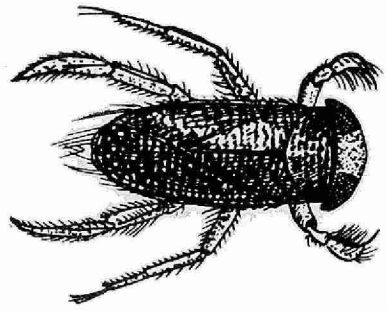


2. DRAGONFLY

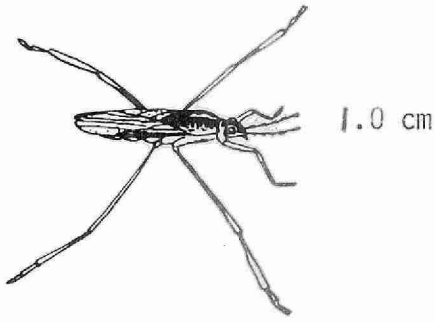
5.0 - 7.6 cm



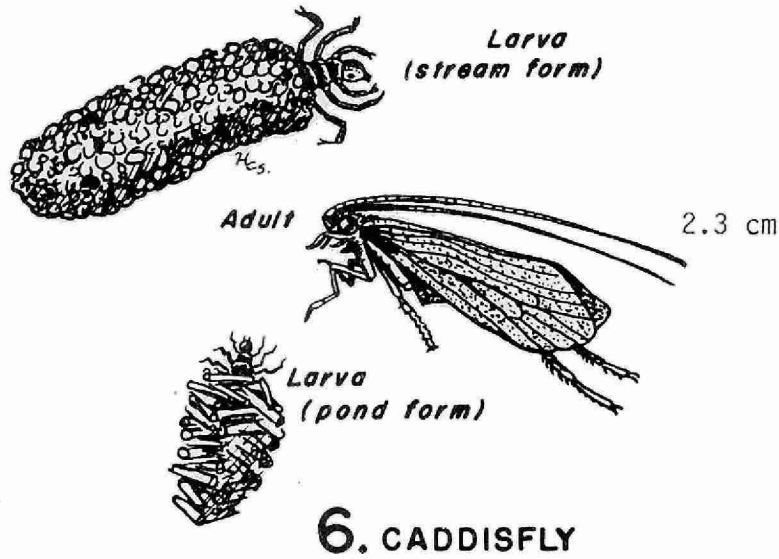
3. STONEFLY



4. WATER BOATMAN



5. WATER STRIDER



6. CADDISFLY

7. Whirligig Beetle (Coleoptera)

These are found on the surface of slow moving waters, taking advantage of the surface tension. The Whirligig beetles, true to their name, whirl or swim on the water's surface. When disturbed they dive under the water, frequently. Their bodies are dark colored, robust, and the front legs are long and slender.

8. Crane Fly (Diptera)

The larvae of the Crane fly are found in scum of shallow waters, in the damp soil along streams or lake shores, and marshy areas. The adults are never truly aquatic and may be found great distances from water. The adults look much like giant mosquitoes without a beak.

9. Mosquitoes (Diptera)

Mosquitoe larvae are usually found in stagnant slow moving water. Most people are familiar with the appearance of adults and know that they are more abundant around marshy, damp areas. The young are often called "wigglers" and can usually be found wiggling about just under the water's surface. Contrary to popular belief, not all mosquitoes bite, the males just buzz and are not equipped for biting.

10. Black Fly (Diptera)

The larvae are found in flowing water (only) on stones, vegetation, or other objects, usually in the swiftest part of the stream. In many cases, the larvae are so numerous they appear moss-like over the surface of the attached object. Later on in life, they live in a cocoon which is customarily a boot-shaped structure. The Black fly as the name implies, are usually dark compactly built flies, with rounded black and short broad wings. The adults may be found great distances from water.

11. Midges (Diptera)

Larvae are most abundant in the shallow water areas of lakes, ponds, and streams favored by a heavy growth of aquatic plants. They prefer soft mucky bottoms, as they are a bottom-dwelling species, and need this type environment for constructing their tube-like homes. Larvae live in soft tubes, however, during later stages of life they are found living in silken cocoons or gelatinous cases. The adult Midges look much the same as mosquitoes. Their antennaes look like two feathers on the front of their head and they don't have a beak.

AQUATIC INSECTS

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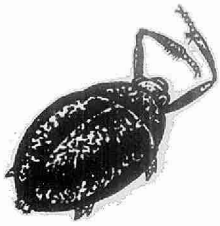
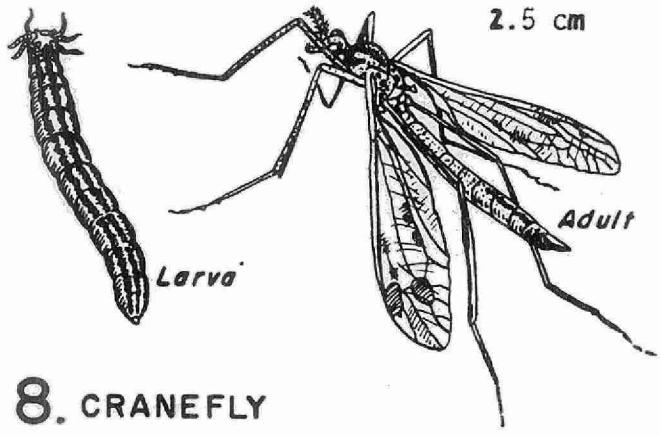
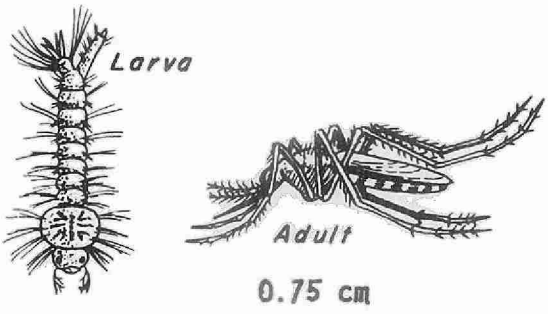


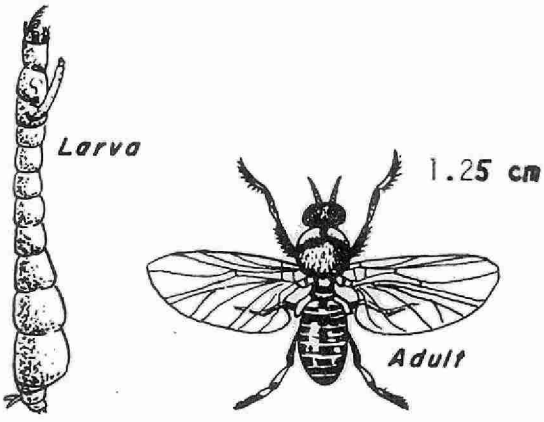
7. WHIRLIGIG BEETLE



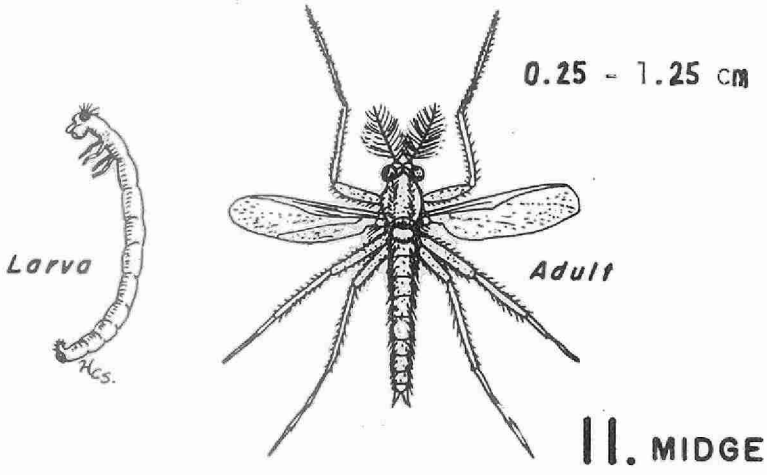
8. CRANEFLY



9. MOSQUITO



10. BLACK FLY



11. MIDGE

SURFACE FRESH-WATER ORGANISMS

1. Planaria (Turbellaria)

Planarians are fairly common in ponds, lakes, springs, and other fresh waters among vegetation, beneath stones, or crawling over the bottom. These free-living flatworms are usually arrow-shaped and vary in color from white to black depending on species and environment. Small planaria look much the same as the adult differing only in size.

2. Bryozoan Colony (Broyozoa)

Fresh-water Bryozoa are very common in lakes, ponds, and rivers. They are community dwellers, living in jelly type substance which is formed on sticks as a gelatinous ball or a mossy mat over the surface of underwater objects. There is a wide range in color, some colonies are brownish and still others have a greenish tinge. Colonies are made up of thousands of these tiny animals.

3. Leech (Hirudinea)

Leeches make homes in lakes, ponds, or other fresh-water areas. They can be seen moving about underwater by their well-known "Measuring Worm" type of travel, or swimming freely. Leeches are predatory or parasitic segmented worms with sucking discs which are used in attachment, movement, and feeding. They are usually dark brown to black in coloration.

4. Daphnia (Cladocera)

Daphnia are found in all sorts of fresh waters. The shallow, weedy backwaters of a lake whose water level is fairly permanent harbors greater numbers than any other kind of locality. These little crustaceans are virtually transparent, and are best recognized by their two-branched antennae, robust bodies, and sharp-tailed spine.

5. Cyclops (Copepoda)

These little fresh-water crustaceans are very familiar in all slow moving waters, especially shallow ponds. Their bodies, like the Daphnia, are very transparent and are characterized by the forked antenna and the branched tail. The female usually has two groups of eggs attached to her body just ahead of the tail.

6. Fairy Shrimps (Anostraca)

For the most part, fairy shrimps live in temporary pools and ponds of fresh water. They are frequently seen underwater, rowing themselves about on their backs, by means of numerous, similar, flattened appendages. These appendages are always faced toward the source of light.

7. Fresh-Water Shrimp (Malacostraca)

These are found in lakes, streams, and ponds in eastern and western Oregon. Shrimp are usually found among the aquatic plants, rocks, and algae. Usually they are nearly transparent and look something like a "sow bug".

SUB-SURFACE
FRESH WATER ORGANISMS

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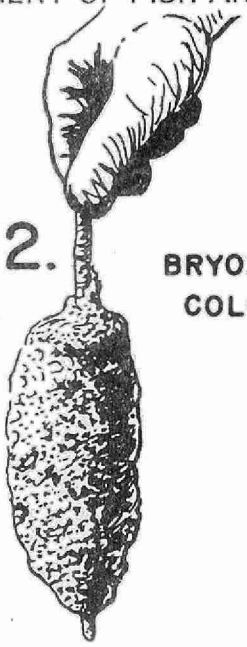
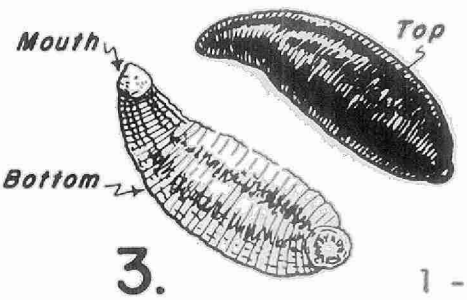
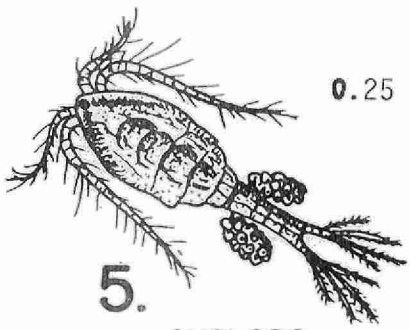
1. PLANARIA



2. BRYOZOAN COLONY

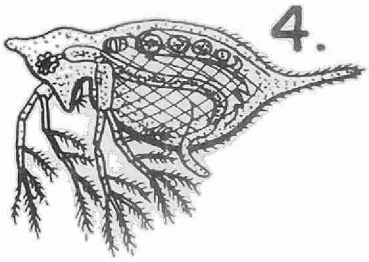


3. LEECH 1 - 5 cm

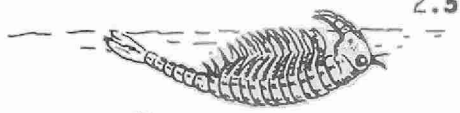


5. CYCLOPS 0.25 cm

DAPHNIA

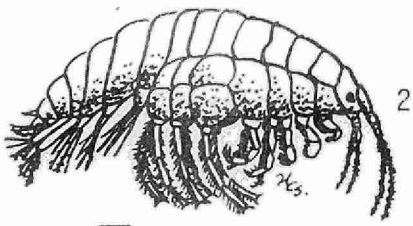


4. 0.16 cm



FAIRY SHRIMP 2.5 cm

6.



7. FRESH WATER SHRIMP 2.5 cm

Insect Sightings in Winter

Springtail (Achorutes nivicolus)

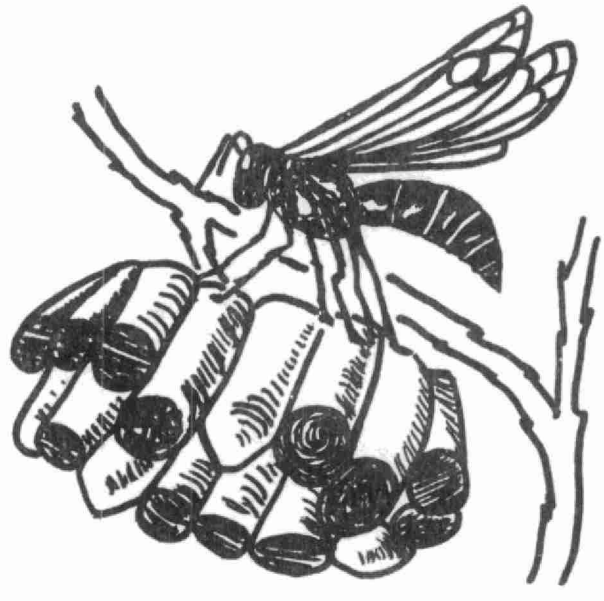
Springtails or "snow fleas" can be found at the base of a tree on warm winter days or where the sun has melted through to a patch of leaves. They are very small and at first may appear to be soot. They generally inhabit the surface of the soil, but may also live on the surface of ponds and in tidal zones. Their common name, springtail, refers to the two appendages they have on their last body segment. These are like two modified legs which are normally folded against their abdomen and held in place by two clasps. When the clasps open, these two appendages spring against the ground, propelling the insect a few inches away. This movement has resulted in their misleading nickname, snow flea.

Stonefly (order Plecoptera)

Stonefly larvae, which live in streams, start feeding and growing in fall and early winter. The adults emerge from the water in midwinter and mate on the shores; then the females lay their eggs back in the water. They are often found crawling over rocks and snow at stream edges, where as adults, they come to feed on algae. Stoneflies can live in only clean rushing water, the larvae living and feeding under stones at the river's edge. When they fly they appear like large gray mosquitoes.

Paper Wasp (Polistes fuscatus)

Male and femal wasps mate in the fall, and both go into hibernation in rock crevices and rotting logs. Only the queen lives through the winter, emerging in the spring to seek out a good nesting site. She then builds a few cells and lays an egg in each one. At this point, other queens which did not complete their own nests, join our queen and become her workers, finishing cells that she initiates and feeding the larvae when they hatch from the eggs. After the larvae are full-grown white grubs, they seal off their cells and pupate, emerging later as female workers.



At the end of summer, the queen lays more eggs which are fed extra amounts of food and develop into idle males and queens. These types hang around the nest and are fed by the workers. In the fall the males and new queens leave the nest, mate, and hibernate. Only the queens with extra reserves of fat stored in their bodies live through the winter to resume the cycle in the spring.

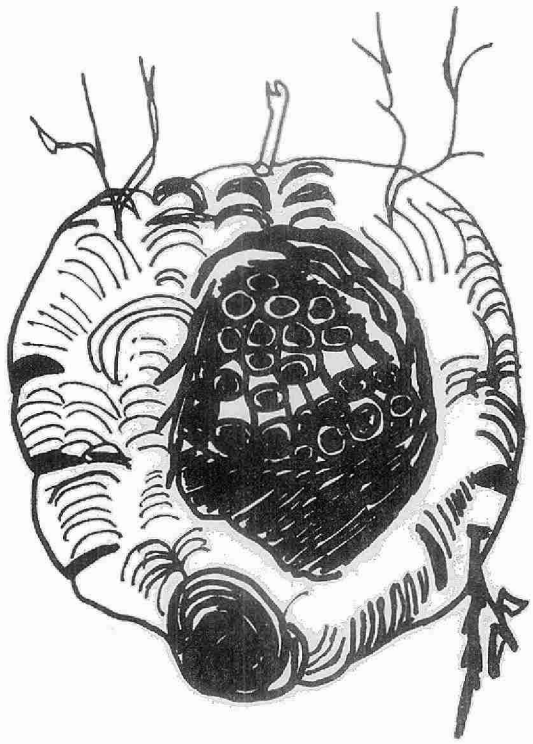
The nests themselves, are often found on the ground in the winter, blown there by the wind. Other good spots for seeing them are in abandoned sheds, garages, barns, and under the eves of wooden buildings.

They are made with dried wood and plant fibers, which are gathered from fenceposts, old buildings, and dead trees. The wasps take the wood bits to the nest, chew them, mix them with saliva, and apply them as paper pulp in circular motions to each cell. Variations in color of the cells, reflect the different sources of wood.

The nests are hung with the cell openings facing downward and are attached usually by a single thread-like *pedicel* (stalk). The top of the cells are usually coated with a shiny substance that makes the paper water-resistent.

Hornets, Yellow Jackets (Vespula species)

The life cycle of hornets and yellow jackets is the same as that of the paper wasp except that the queen is never joined by other queens.



The nests are abandoned in winter and can be safely collected and inspected after below-freezing weather has set in. They are built at any level, in trees, shrubs, or sometimes under the eves of house roofs. They vary in size from 20 to 45 cm in depth (those of Yellow Jackets often being the smaller ones).

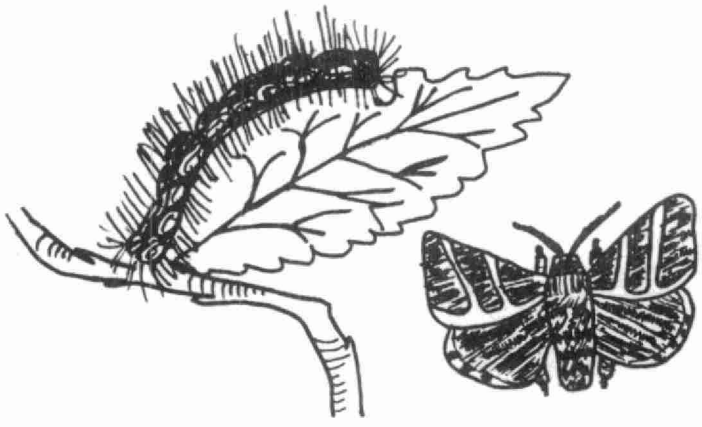
The nests of these insects are more advanced than those of the paper wasps. After the first workers hatch, they build new cells and enlarge the nest by chewing away the inner layers of the envelope and adding new layers to the outside. Paper is made by collecting strips of dried wood, chewing them, and adding a fluid that acts like glue to hold the paper together. The paper is added on in arcs that curve away from the hive. This makes the layers quilted and holds them apart so that their insulating effect is maximized. Most nests have between six and eight layers of paper, the total covering averaging 5 cm in thickness.

If you cut open part of a nest, you will find that some of the cells may be short, which means they were never finished; some cells may contain dry larvae, which means the nest was abandoned before they matured; other cells have an added white layer of paper. These cells were going to be used a second time.

The entrance to the hive is a hole placed in one side at the base. Although the wasps abandon the nest in the winter, many other types of insects and spiders spend the winter within it.

These nests are also built underground in a mammal burrow or natural cavity. They are often found in the fall, torn open by skunks or racoons, who were seeking the grubs when the insects were slowed by the cold.

Eastern Tent Caterpillar
(Malacosoma americana)



The nests of the Eastern Tent Caterpillar are not particularly attractive in winter, when they appear as ragged masses of webbing filled with dried leaves and crumbling excrement, but they are a common sight once the leaves have gone from the trees.

In spring, when the eggs first hatch, the caterpillars crawl down the branch to the first large joining of two branches. Here they build a web for protection against such predators as birds and other insects. To feed, they leave the nest and crawl up the branches to the leaves.

The webbed nest is made communally and soon becomes filled with the remains of the caterpillar feces, as well as molted skins, for the larva, like insects in all stages of growth, must shed its skin as it grows. The caterpillars continue to add on layers of webbing, so that the final nest is made up of many layers filled with excrement and molted skins. This stage lasts six weeks. At this point, after a certain number of molts, they drop from the nest and spin cocoons in sheltered areas.

In three weeks they emerge as adult molts, then they mate and the females lay their egg masses on host twigs. These egg masses can also be found in winter. They contain 100 to 300 eggs and are surrounded with a shiny, waterproof, foamy material. An excellent place to spot egg cases is a group of Black Cherry or Chokecherry trees.

Old nest of tent caterpillar

Grass Plants

Since grasses are easy to identify when they are in flower, and only weedy grasses usually flower in a regularly mowed lawn, most of the grasses listed are weedy species. Flowers are usually green, brown, or beige.

Crabgrass

Fat leaves, yellowish-green in color, often hairy. Best way to tell is to look at flower. Spreads by seed and runners. Annual.

Bermuda Grass

Thick, coarse grass. Stems are smooth and wiry. Runners have many jointed parts with roots at each joint. Flower somewhat similar to crabgrass. Perennial.

Goosegrass

Low, thick mat-forming grass, growing from central point. Appears as a silvery, pale green clump. Will flower even under constant mowing. Distinctive flower. Annual or short-lived perennial.

Ryegrass

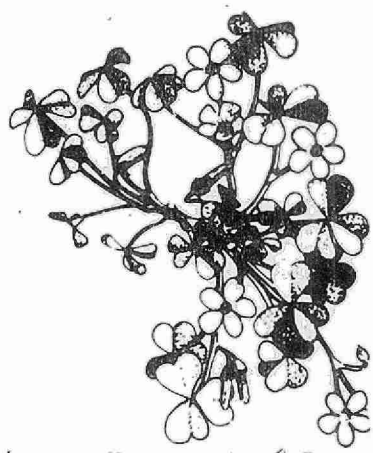
Long, narrow leaf, hard to tell from regular lawn grass unless flowering; somewhat glossier than most grasses. Forms clumps. Annual or short-lived perennial.

Moss

Small, short, soft stemmed plants. Many plants to a patch. No flowers. Found in over-watered lawns. Annual.

Oxtails/Sourgrass

Looks like clover, but not related. Prefers shade. Grows low with runners. Flowers yellow, small. Stems taste sour. Perennial.



Knotweed/Knotgrass

Very low growing; forms circular mat. Found in areas with lots of foot traffic. Slender, wiry, non-rooting stems. Leaves bluish-green and smooth. Very small white flowers.

Mallow/Cheese Weed

Stems low and spreading. Leaves roundish and broad. Fruit looks like little rounds of cheese. Annual or often a biennial.

Kentucky Bluegrass

Very common and desirable lawn grass. Can be identified in cut stage by looking with a hand lens at veins on upper side of leaf -- look like railroad tracks running down the middle. Will flower along uncut edges of lawn; very tall, from 1 to 2 feet high. Perennial.

Annual Bluegrass

Short, soft, light-green grass. Will continue to form flowers and seeds even under frequent mowing. Usually found in cool, frequently watered areas. Look for light-colored flowers growing on short grass plants in lawn. Annual.

Foxtail/Wild Barley

Occurs as clumps, often in new or infrequently mowed lawns. The leaves are smooth, dull green. The mature seed heads look like a squirrel or fox tail. Often sticking in socks or shoes.

FUNGI

Mushrooms

Many kinds of fungi appear on lawns. Most are in the familiar toadstool shape. Others are button-like. They are usually white or light brown, but can range from bright red, blue, yellow to black. Many are poisonous. Mushrooms do not manufacture their own food, but live off decaying plant material.

Non-Grass Plants

Chickweed

Slender, much-branched stems with a line of white hairs along one side. Leaves smooth and pointed. Likes it cool. Annual.

Scarlet Pimpernel

Low growing. Stems branched. Most identifiable feature: under a clear sky salmon-colored small flowers are easily seen. Annual.

Dandelion

Almost stemless, with jagged leaves growing in a circle around the base of the plant. Flower stalks rise from the base. Easy-to-see yellow flowers turning into familiar puff-ball seed head. Annual, biennial, or perennial.

Sedge

Very narrow and stiff-leaved plant. Without its flower it looks very grass-like. Unmistakable flower stalk: Little clusters of green flowers growing at the base of six spike-like leaves. Triangular stem, usually taller than lawn. Grows in very wet areas.

Spurge

Very low growing; stems form circular mats from single root. Stems and leaves are green or often reddish. Positive identification -- pinched leaves yield a milky sap (poisonous). Annual.

English Daisy

Low growing with oval leaves. Flowers stick up. Easy-to-see white or pinkish daisy-like flowers. Perennial.

Clover

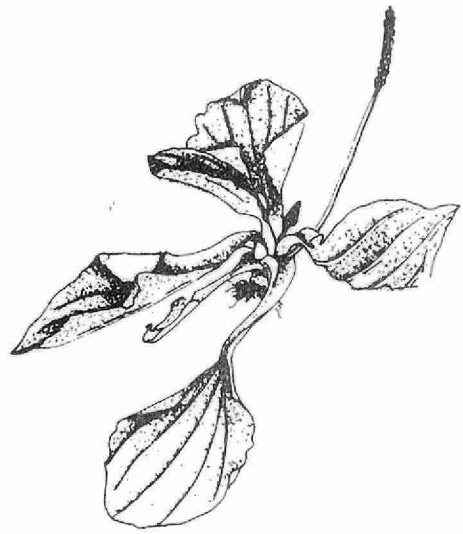
Common, non-grassy lawn plant. Three-lobed leaf. Low growing, roots at joints. Flowers white, red, or pink. Perennial.

Burclover

Related to clover. Clover-like leaf. Stems are low growing and spreading. Flowers are small and yellow. Seed pod or "bur" is spiraled and spiny. Annual.

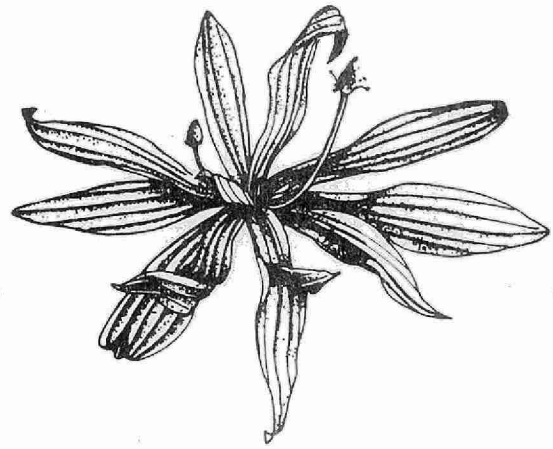
Broadleaf Plantain

Large, smooth, roundish leaves, 3 to 6 inches long. Flower stalks 3 to 6 inches long are easily seen sticking up from the plant's centre. Perennial.



Narrowleaf Plantain/Buckhorn

Long, narrow leaves with parallel veins, 3 to 12 inches in length. Long flower stalks stick up above leaves. Perennial.

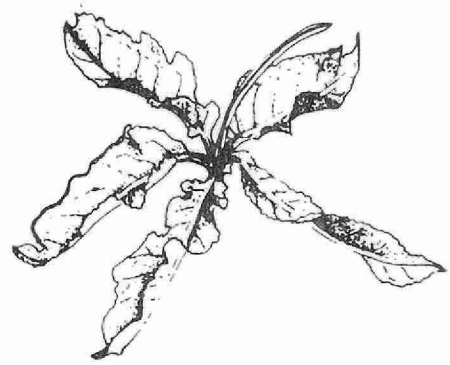


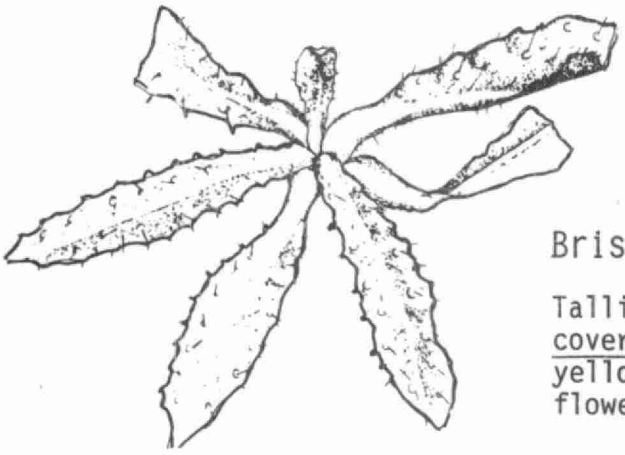
Thistle

Almost stemless, with leaves notched with long spines that hurt if touched at edges. Leaves are spiny and have short hairs and "pimples". Flowers, when present, are purplish. Perennial.

Curly Dock

Almost stemless, with large, reddish-green leaves that are curly and wavy along the edges, growing in a circle around the base of the plant. Flower stalks appear in the centre of the plant and are green or reddish-brown in color. Perennial.





Bristly Oxtongue

Tallish. Coarse, rough-looking plant. Leaves covered with rough hairs and pimples. Flowers are yellow and look somewhat like small dandelion flowers. Biennial.

Dichondra

Low, creeping stems, root frequently at nodes. Can form dense mats, or even "lawns". Leaves lily-pad shaped; 1/4 to 1-1/2 inches in width. Flowers rarely seen. Perennial.

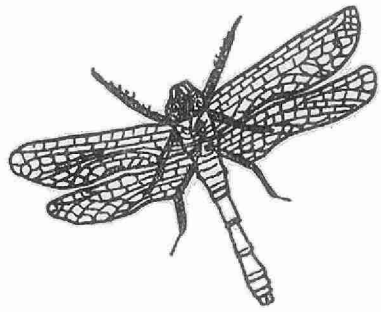
Cutleaf Geranium

Low growing, many branches per plant. Leaves are divided into narrow fingers. Easily seen small purple flowers. Annual.

Small Flying Animals

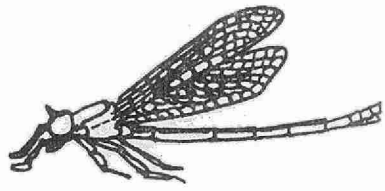
Dragonflies

Brightly-colored, fast-flying insects. Hard to catch. They have four large wings, which are held out when at rest, and a large head. Food: small flying insects.



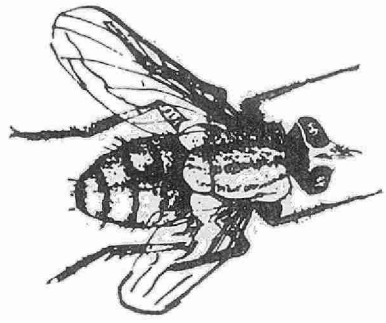
Damselflies

Look like skinny dragonflies. Wings are held close together and point backwards when at rest. They are usually very brightly colored. Food: small flying insects.



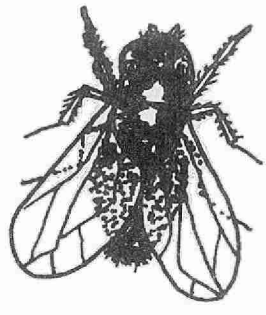
Frit Flies

Small black flies. Usually very numerous. However near lawn surface. Food: larvae feed on grass stems.



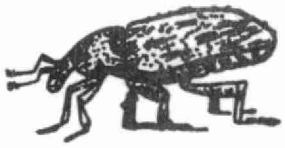
Houseflies

Several species of medium-large flies, all of which look something like the common housefly. The location of your lawn will determine the exact species. Stout-bodied, very active; single pair of wings. Food: scavengers on all sorts of decaying vegetable and animal waste matter.



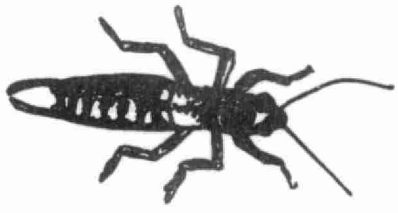
Weevils/Snout Beetles

As their name implies, these are beetle-like in appearance, with the head more or less elongated into a snout. Weevils, like beetles, prefer to run rather than fly. Food: almost all feed on plant material.



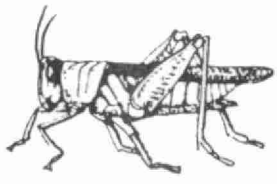
Earwigs

Slender, medium-sized insects with large pincers on the end of the abdomen. Earwigs are largely active at night and hide during the day in cracks, crevices, and under objects. Food: mainly scavengers, but also eat live plants.



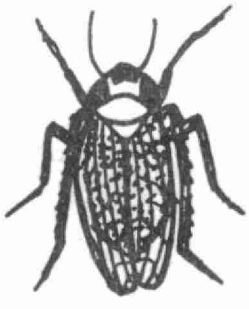
Grasshoppers

Long-legged, jumping insects. Usually green or brown, they range in size from 1/4 inch to over 3 inches. Very large hind legs to aid in hopping, they also fly. Males sing by rubbing the inside of the hind leg against the lower edge of the front wing. Food: plant feeders.

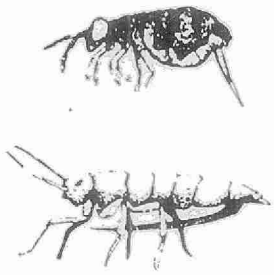


Leaf Hoppers

Small bugs, very numerous at certain times of year. Oval-shaped body, segments not well separated. Will move sideways, hop, or fly. Often interesting coloration: black, brown and white, or all green, some with red markings. Food: suck plant leaf juices.



Springtails

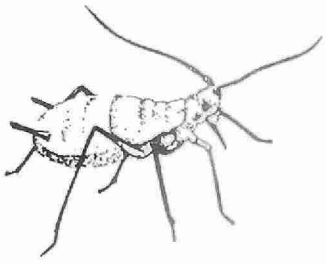


Tiny wingless insects that are very plentiful. They are named after their unique forked tails that they keep folded beneath their body. When disturbed, the tail springs downward, catapulting the insect into the air. May be dark-colored, yellowish, or colorless. Not likely to be caught with nets, but very likely found in traps. Very numerous in the soil. Hand lens is really needed to see them well. Food: scavengers, some feed on microscopic plants.

Ants

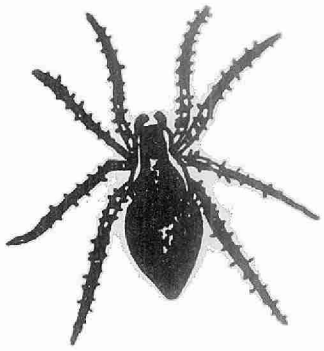
Small, black (sometimes red), narrow-waisted, round-dwelling insects (rarely, winged ones can be found). Often found in large numbers, in swarms or lines. Antennae are usually elbowed. Familiar insect, lives in large colonies. Food: varied; some ants are predators, some herbivores, others scavengers.

Aphids



Small, round, soft-bodied insects. With wings at certain times of year, without wings the rest. Usually green, can be black or brown. With a hand lens, one can see tiny pegs sticking up from rear of abdomen. Food: adults and young suck plant juices.

Spiders



Many kinds of spiders can be found on lawns. All have eight legs, two body segments, and piercing mouth parts. Many spin webs to catch their prey; others, like the wolf spider pictured here, don't have webs but pounce on their victims. Food: all are predators.

Bees

Familiar honey bee with hairy, yellow and black striped abdomen. Usually found near or on clover, dandelion flowers, or other showy non-grass plant flowers. Food: pollen and nectar from flowers, nectar converted into honey back at hive.

Yellow Jackets

Very showy insects with bright black and yellow markings on its non-hairy abdomen. These wasps are pesty and will sting if disturbed. Food: scavengers, very noticeable during picnics.

Small Wasps

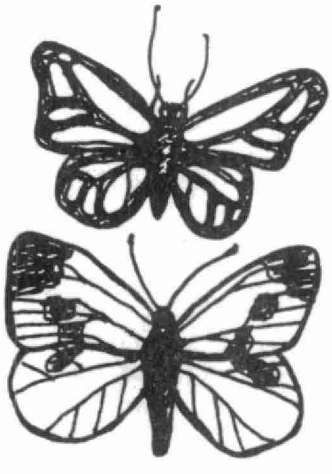
Any of a number of species of small, black, narrow-waisted wasps. Common in small numbers at all times of the year. Food: most are parasitic, laying their eggs into a host insect; the larvae feed on that host from the inside, eventually killing the host.

Butterflies

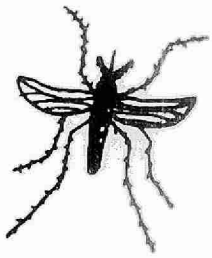
Slender-bodied insects with large, often brightly-colored wings. Wings are covered with tiny scales. Antennae are slender with a swollen knob at the end. Food: adults often don't feed -- if they do, usually on flower nectars; larvae feed constantly on plant material.

Pictured here:

Monarch - black and orange
Cabbage - white and black

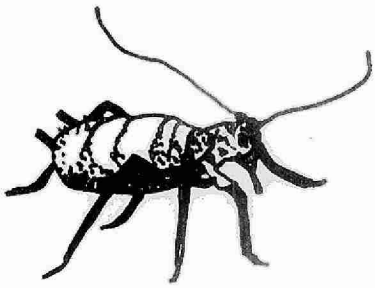


Typical larvae or caterpillar



Mosquitoes

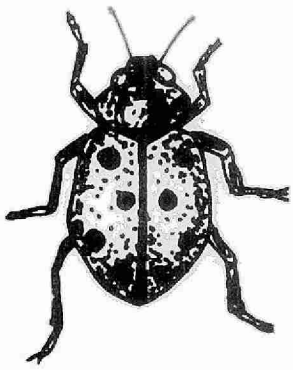
Skinny, long-legged small flies. Only one pair of wings, which are fringed with tiny scales and hairs (a hand lens is needed to see these). Most have long, piercing, sucking mouth parts. Food: females suck blood, males feed on nectar and plant juices.



Aphids

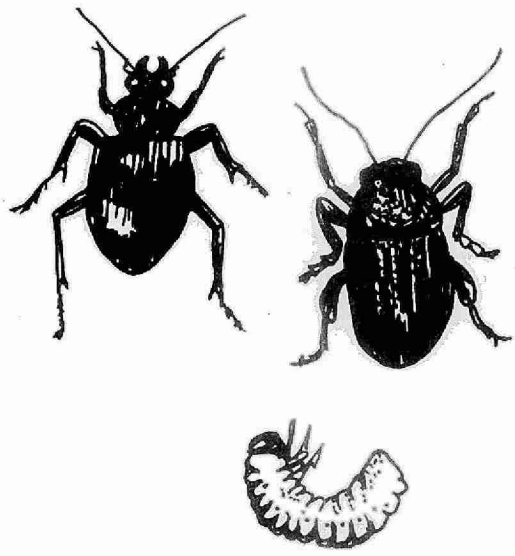
Small, round, soft-bodied insects. With wings at certain times of year, without wings the rest of the year. Usually green, can be black or brown. With a hand lens, can see tiny pegs sticking up from rear of abdomen. Food: adults and young suck plant juices.

Small Non-Flying Animals



Ladybug/Ladybird Beetles

Medium-sized, round, reddish-orange beetles with black spots (or reverse coloring). Often very common. Can be seen crawling to top of a blade of grass, flying a short distance, and repeating the action. Food: both adults and larvae are predators; favorite food is aphids.



Beetles

Many types of beetles can be found on lawns; only the ladybird beetle is common enough to be specifically identified here. Beetles range in size from less than 1/8 inch long to 1 inch long. Pictured here are two kinds likely to turn up. A ground beetle and a flea beetle. Beetles are all hard-bodied and rarely fly. Their wings are folded under their hardened backs. Food: some are predators, others are herbivores, still others are scavengers. Ground beetles are mostly predators, flea beetle adults feed on leaves, and the larvae feed on the roots of plants, particularly dichondra. Larvae often eat different food than adults.

Mites

Tiny spider-like animals; all adults have eight legs. Mites look like fast-moving dots. Colors vary; red, orange, brown, and black are most common. Food: varies; some are predators, others herbivores or scavengers.

Millipedes

Medium-sized, elongated, wormlike animals with many legs. Most millipedes have 30 or more pairs of legs, usually two pairs per segment; Often millipedes can be found rolled up into a ball. Food: most are scavengers.

Centipedes

Medium-sized, elongated, flattened, wormlike animals with 15 or more pairs of legs. Each body segment has a single pair of legs. Very active and fast-running, unlike millipedes. Usually orange in color. Some will bite or sting if held in the hand. Food: predators.

Isopods/Pill Bugs/Sow Bugs

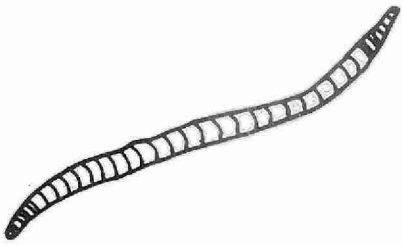
Medium-sized, oval-shaped, armored animals. Brown, black, or grey in color with yellow spots. Legs originate underneath the armored back and often can't be seen from the top. When alarmed, pill bugs roll up into a tight ball, or "pill". They live in cracks, crevices, or even out in the middle of the lawn. Mainly active at night. Food: mainly scavengers, but will eat fresh plant material.

Snails

Soft-bodied animals with a hard, coiled shell. Very small snails can be quite plentiful in lawns, especially ones around 1/16 inch. Food: fresh and decaying plant material.

Slugs

Look like snails without shells. Both snails and slugs travel on a slippery substance that they secrete; they thus leave a track where they have been. Food: fresh and decaying plant material.



Earthworms

Segmented worms with a large band around the body about 1/3 of the distance from the head. Size varies from 1 inch to over 6 inches. Earthworms are very numerous in lawns, frequently come up after the lawn is watered or at night. Food: scavengers; eating material in soil.

BIRD IDENTIFICATION

When bird watching, you may find that the bird does not stay in sight long enough for you to find it in an identification book. To assist you, therefore, the following data sheet has been prepared. Using the preceeding three pages as a guide, fill in the form and then take the time to find the bird in a nature book.

DATA SHEET

SIZE A

SHAPE

General B

Bill Shape C

Tail Shape and Markings D

SIGHT

Main Color

Special Markings E

FEET F

SPECIAL HABITS

FLIGHT PATTERN

Description

Sketch

Name of Bird

Site

Prepared by the staff of the Kingfisher Lake Outdoor Education Centre, Thunder Bay, Ontario.

A SIZE

SPARROW SIZE
5¼" TAIL TO BEAK
(13 cm)

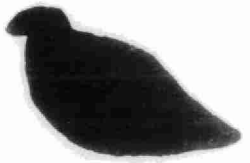
ROBIN SIZE 8½"
(31 cm)

CROW SIZE
(43 cm)

Estimate the size of the bird you are observing -- is it smaller than a sparrow? Larger than a sparrow but smaller than a robin? Express approximate size in cm.

B GENERAL BODY SHAPE

chunky as a meadow lark



plump as a grouse

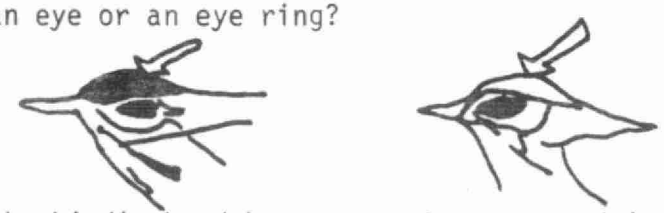
slender as a swallow

downright bulky as an owl

Does the shape of the bird that you are observing compare with any of the above? If not use words that you think describe the shape of the observed bird.

E SPECIAL MARKINGS

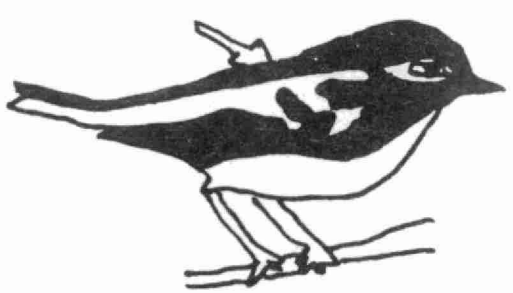
Special Markings. Characteristic markings help in observing birds. These are known as "field marks". Does the bird have an eye or an eye ring?



Does the bird's head have a crest, crown patch or crown stripes?

Is the breast striped, spotted or unmarked?

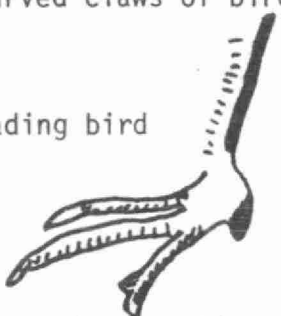
How many wing bones are there?



F FEET

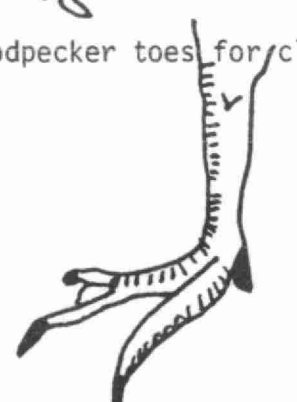
Curved claws of birds of prey.

Long legs of a wading bird



Feet of a perching bird

Woodpecker toes for climbing trees



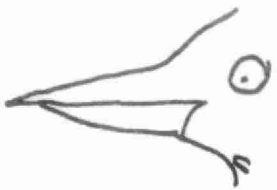
Webbed foot of a duck

What kind of feet does the bird that you are observing have?

C BILL SHAPE

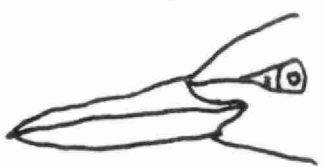
The hooked bill of the hawk is used to tear away prey.

The chisel-tipped bill of the woodpecker is used to dig insects out of the wood.



The strainerlike bill of the duck is used to seive food from the water.

The stout, heavy bill of the seed crackers.



The spearlike bill of the heron is used to catch fish and frogs.

What kind of bill does the bird that you are observing have?

D TAIL SHAPE AND MARKINGS

Is the tail forked, squared or rounded? If not use other words to describe the tail.

Does the tail have

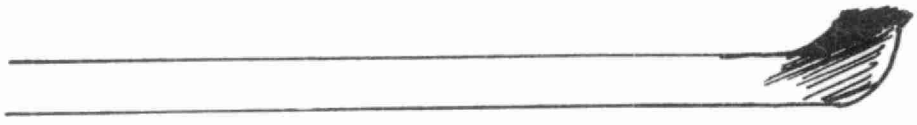
outer white tail feathers, white tail tips, tail band or colored rump patch?

Games People Play

WINTER GAMES

Snow Snakes

Throwing the snow snake was one of the favorite games of the Iroquois Indians. The "snake" is a smooth stick about 1 m long, with an up-curved head and about 2.3 cm thick.



You can make one from a stick or a branch which has fallen from a tree. If using a branch, strip the bark and smooth the underside.

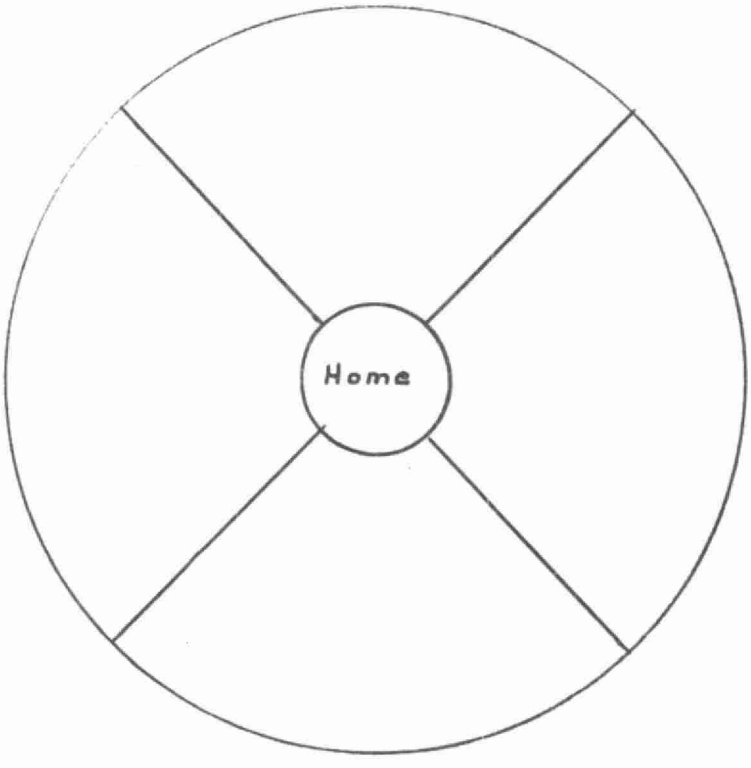
Make a trail for the snow snake by dragging a log in a straight line across a field or lake. The Indians used to wet the trail and let it freeze overnight.

Hold the stake at the end with the ball end resting in the groove in the snow. Throw the stake like a bowling ball. The winner is the one who can slide the snake the farthest. (The Iroquois players reportedly used to slide the snake more than half a mile on smooth lake surfaces.)

You can play with as many players as you like. The Indians played in teams of six.

Fox and Geese

Tramp a large circle in the snow and then make two paths across the centre dividing the circle into four parts. If many play, the circle should be extra large and two concentric circles can be used with six paths. Tramp a home in the centre about 1 m in diameter.



Players must remain on the paths. One person is "it" -- the fox. He chases the geese. When the fox tags a goose, the goose becomes the fox and chases someone else. Players cannot be tagged when standing in home.

Snow Angels

Lie down in the snow with arms straight out. Now move arms up and down between head and legs to make the wings. Get up carefully and you have a snow angel.

Battle of the Beaks

Different species of birds eat different things. Some birds prefer insects, some like grain, others are nectar-eating. The beaks of all birds are adapted to help them obtain the type of food they need. (See bird identification chart -- bill shape.)

Equipment:

- strainer or small fish net
- spoon
- pliers
- scissors
- tongs
- meat baster
- small beans

Activity:

Scatter the beans on a tabletop, on the carpet, float some in water, bury some in sand, and glue some to a board.

Object:

Using the various tools, have the youngsters try to pick up the beans. Describe the various types of bird beaks and have children try to match each tool to a bird beak. For example, the meat baster will be useless in picking up beans and this frustrates a child but then imagine how a hummingbird would feel trying to eat a bean.

Discuss how an area would need a variety of food sources to support different types of wildlife.

Micro-Trails

If you were a tour guide, what sort of things would you show the members of your group?

Equipment:

Ten popsicle sticks or toothpicks and 3 m of string for each person involved.

Tour guides must map out their trail using the sticks as sign posts. Attach the string to the sticks. Your trail cannot be longer than the string. After you have designed your trail, take someone on a tour of it.

Note: When laying out your trail and viewing someone else's your feet must never touch the ground. In other words, you must crawl on your hands and knees or wriggle on your stomach. The purpose of this is to get your eyes and nose closer to the ground where things are happening.

Some ideas for trails are to show off different shades of green; to point out different little flowers in the grass; to pick out different spots for a home-hunting spider; to show off the new buds in your area.

QUIET GAMES

WHAT AM I?

A player leaves the room and the group decides what animal or other nature object he shall represent. The player returns and tries to discover what he represents by asking questions on characteristics that may be answered by "yes" or "no". When he identifies himself, the person whose answer helped him make the discovery leaves the room next.

Variation: Ask a player to think of an object and write it down on a slip of paper. The rest of the group may then ask him questions which can be answered "yes" or "no" until they find out what the object is.

Variation: Have a panel of four who ask questions. They may play as "20 questions" and ask only 20 questions, taking turns, or they may ask any number of questions.

Variation: Have a number of clues describing a nature object written on a card with the most difficult clue listed first and each clue becoming easier or more obvious. Read the clues one at a time until someone guesses what the object is. The player guessing correctly gets to keep the card. If an equal number of clues are used for all objects one might give scores by the number of clues it takes to guess the object.

* * * *

WHAT IS WRONG WITH THIS PICTURE?

Announce that a certain nature object is to be described and, although most of the characteristics given will be true, a few false ones will be included. See how many can detect the incorrect ones.

* * * *

NATURE CHARADES

Played like regular charades, either in teams or individually, by acting out the word. Some examples of nature categories:

Flowers:	carnation	car - nation
	sweetpea	sweet - pea
	dogwood	dog - wood
	marigold	Mary - gold
	lady slipper	lady - slip - her
	lady finger	lady - finger
	foxglove	fox - glove
	touch-me-not	touch - me - not
	primrose	prim - rows
	four-o'clock	four - oh - clock
	bettersweet	bit - her - sweet

NATURE CHARADES (cont'd)

Birds:	sparrow	spare - row
	thrasher	thrash - her
	towhee	tow - he
	warbler	war - blur
	woodpecker	wood - peck - her
	vireo	very - oh
	kingfisher	king - fisher
	killdeer	kill - deer
	pintail	pin - tail
	catbird	cat - bird
	grosbeak	gross - beak
Trees:	basswood	bass - wood
	hornbeam	horn - bean
	buckeye	buck - eye
	catalpa	cat - tall -pa
	sycamore	sick - ah - more
	walnut	wall - nut
	tulip tree	two -lip - tree
	tamarack	tam - ah -rack
	mulberry	mull - berry
	chestnut	chest - nut

Excerpts from "A Leader's Guide to Nature-Oriented Activities" by Betty Van der Smissen and Oswald H. Goering. The Iowa State University Press, 1977. Price $6.95.

seek and solve

T	H	E	T	R	A	S	H	R	E	S	L	E
B	I	R	T	T	E	E	R	L	A	L	S	L
U	I	L	O	V	A	E	A	A	R	I	A	E
D	N	D	S	T	M	R	O	W	O	G	I	C
N	T	H	R	E	U	A	L	N	I	R	I	T
T	W	E	I	T	L	I	I	L	G	E	T	R
E	E	V	A	D	T	E	O	N	W	O	R	I
S	U	N	U	T	E	S	S	D	U	O	L	C
E	I	M	E	F	W	E	E	D	O	N	T	S
T	P	R	E	U	S	E	W	A	R	T	T	O
C	A	O	R	E	W	E	A	O	M	U	S	T
R	E	C	L	Y	C	L	E	R	L	O	U	R
R	E	W	O	L	F	A	E	L	S	L	G	A
R	I	B	A	E	U	G	E	L	A	T	E	N
M	D	V	A	L	C	T	L	E	E	A	E	Y
R	A	R	E	O	N	U	E	M	G	R	I	M
A	T	N	P	R	O	U	G	S	A	R	G	E
H	R	O	M	U	N	D	O	R	B	S	A	T
N	D	R	E	A	P	L	M	A	E	C	E	A
U	N	N	E	E	D	D	S	E	G	E	D	L
L	S	E	D	O	R	E	N	E	A	O	N	S
U	P	D	N	O	E	I	I	S	B	E	S	W
W	I	I	T	D	U	S	T	H	R	O	Q	E
U	L	I	E	T	E	R	S	O	A	U	R	E
N	L	I	T	T	E	R	B	U	G	D	S	P

Directions:

This puzzle is called a chain reaction. The words to find are listed below. Notice that the first letter of every word is the same as the last letter of the word before it. Find the first word and then the following words will connect to each other. Put a line through the letters as you find the words. The letters that are left over form a poem below. Take the spare letters in the exact order they are written and fill them in the blanks. When the poem is completed, all the letters will be crossed out.

BUD	LAWN	EARS	SMELL	MANMADE	SWEEP
DIRT	NOISE	STEM	LEAF	ERODES	PROBES
TRASH	ELECTRIC	MY	FLOWER	SPILL	SEED
HEAT	CLOUDS	YELLOW	RIVER	LITTERBUG	DUST
TREES	SOIL	WEED	ROLE	GARBAGE BAG	TINS
SUN	LITTER	DUMP	EARTH	GRIM	SMOG
NATURAL	REUSE	POLLUTES	HARM	METALS	GREEN

_____ _____ ___ ____ ___ ____ __ ___ ___,

__ ____ ___ ____ _____ __ __ ____ _____ __ ____.

__ ____ _____ ___ _____ ___ _____ __ ___ _____,

___ _____ _____ ____ _____ ____ _____ _____.

SURVIVAL GAME

PURPOSE: To increase Awareness and Appreciation of Wildlife.

OBJECT: To Take on the Role of a Specific Animal and Survive.

NO. OF PARTICIPANTS: 15-40 (or more)

AREA AND EQUIPMENT:

OUTDOORS
- two to three acres of field, bush, and stream
- definite boundaries which outline this area should be defined

LIFE CARDS:
- cardboard or bristol board 1" by 2" approx. with animal names printed on them
- OR - formica samples (they last longer)
- eight required per herbivore
- deer - four, fox - three, wolf - two

SHOWER RINGS:
- to hold life cards

ORIENTEERING PUNCHES: or MAGIC MARKERS:
- at least 20 (more would be better)

FOOD/WATER CARDS:
- one per herbivore
- 1" by 4"

FOOD	FOOD	FOOD	FOOD	FOOD
WATER	WATER	WATER	WATER	WATER

MARKERS OR HATS:
- to define carnivores

TO PLAY:

Each person is assigned an animal which he will be. He may be any one of the below listed carnivores or herbivores. The participants also receive "Life Cards". Each animal receives a varying number of life cards -- herbivores generally get eight or more each, with carnivores receiving three or four. Carnivores receive markers, herbivores a blank (unpunched) FOOD/WATER card.

The herbivores are told that to survive they must find as many food and water sources as they possibly can -- the more the better. The sources are marked FOOD (or WATER) and an orienteering punch is hung at each. Upon discovery, the F/W card is punched. The second thing that they must do to survive is to avoid becoming FOOD for carnivores.

The carnivores are told that to survive they must get as much food (only) as possible, but their food is the herbivores. Upon catching a herbivore (by tagging) the carnivore takes one of the herbivore's life cards, keeps it, and then goes on to get more.

All animals are also susceptible to certain elements such as disease, fire, drought. At least one person should be assigned to be one of these elements. The more animals there are participating, the more elements that can be introduced. Again, disease must tag the animal before receiving a life card.

The final threat to an animal's survival is MAN. When man enters the game (five to ten mins. before the game's conclusion) word is passed among animals, for MAN only has to see the animal to win a life card. He does not have to tag.

ADDITIONAL RULES AND AIDS:

1. A) Foxes may not kill deer.
   B) Foxes may not be killed by wolves.

2. A) Carnivores may not catch the same herbivore twice consecutively. He must catch another one in between.
   B) Carnivores may co-operate on a kill but only one may obtain the life card. Similarly, a carnivore coming upon a recently captured herbivore may not take a life card until he has captured some other herbivore first.

3. All carnivores and disease should be given an extra shower ring to collect life cards on.

4. Carnivores may only survive off their own life cards. They may not use those of their prey.

5. After playing this game a number of times, many innovations may be added. For example, dividing all animals into male and female. The males are given the females' life cards. Before the search for food may begin the pairs must find each other (symbolic mating) and exchange cards.

TO START:

A. Ensure that each person who is an animal has 1) his life cards
   2) a marker of FOOD/WATER card

B. Define the boundaries.

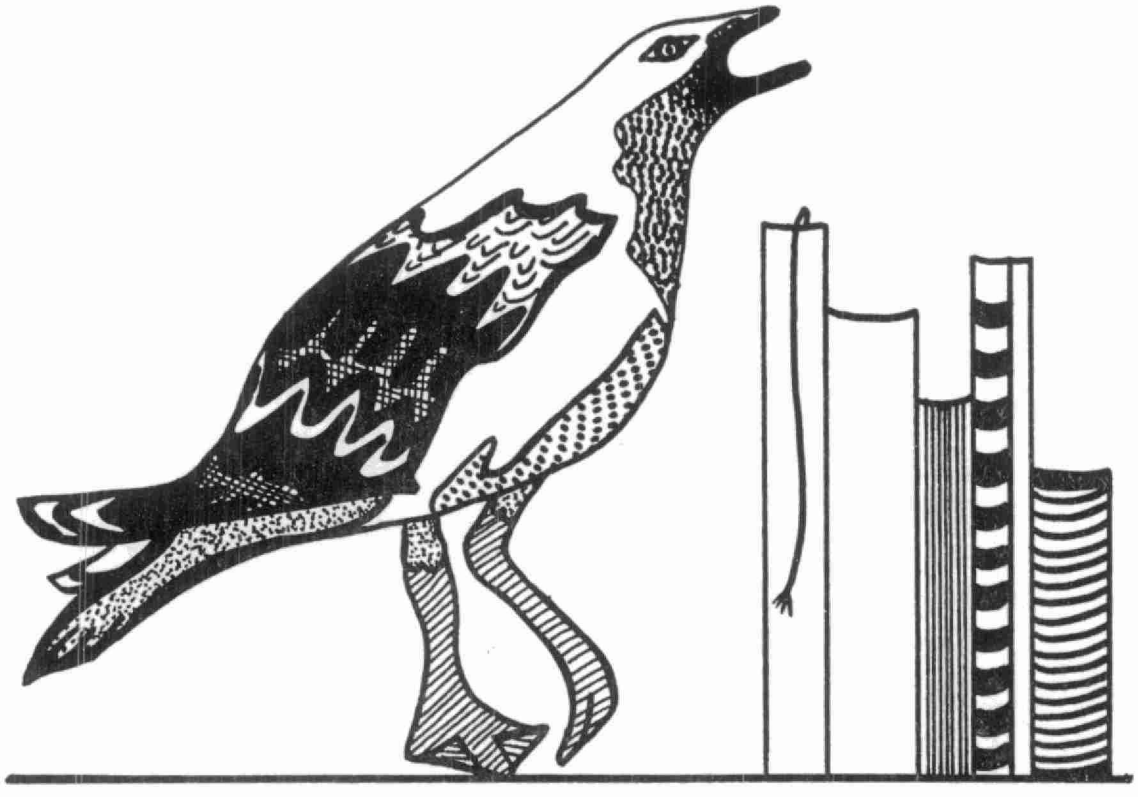
C. Allow herbivores to scatter first. Hold the carnivores, element(s), and MAN.

D. Then in three or four minute intervals let the foxes, then the wolves, then disease, etc, go.

E. The game continues for an indefinite length of time. MAN should never be in before the last ten minutes. (The more life cards each animal has, the longer the game can be played.)

F. Have a follow-up and discussion. How did you feel? What strategies did you use? What happened when man entered? Why does he only have to see to kill? Statistics -- How many were killed by natural predation? By diseases? By man? and so on. (Most important part of game!)

Books for Everyone



BOOK LIST

Unless indicated otherwise, these books may be obtained from the Nature Canada Bookstore, 75 Albert Street, Ottawa, Canada K1P 6G1. All prices are subject to change.

Identification Guides

The Audubon Society Field Guide to North American Birds
John Bull and John Farrand, Jr.
Albert A. Knopf, New York. $8.95

Natural History Notebook
National Museum of Natural Sciences
Sketches and brief notes on 52 magnificient creatures in our animal kingdom.
National Museums of Canada, Ottawa, Ontario K1A 0M8. $1.00

Peterson Field Guides

The Peterson Field Guides are the most famous and widely-used field guides in North America. Based on the Peterson principle of visual identification, they are invaluable to naturalists and students.

A Field Guide to:

The Birds (Eastern)
Roger Tory Peterson
$11.95; paper $6.75

Western Birds
Roger Tory Peterson
$11.95; paper $7.95

Atlantic Shells
Percy A. Morris
$11.95; paper $9.25

Butterflies (Eastern)
Alexander B. Klots
$14.75; paper $9.25

Mammals
William H. Burt
$13.50; paper $7.95

Pacific Coast Shells
Percy A. Morris
$7.95; paper $5.50

Rocks and Minerals
Federick G. Pough
$14.75; paper $9.25

Animal Tracks
Olaus J. Murie
$9.25; paper $7.95

Ferns
Boughton Cobb
$9.25; paper $6.75

Trees and Shrubs
George Petrides
$9.95; paper $7.95

Eastern Reptiles and Amphibians
Roger Conant
$13.50; paper $9.25

Birds of Texas
Roger Tory Peterson
$15.95

Rocky Mountain Wildflowers
Craighead, Craighead and Davis
$9.25; paper $7.95

Stars and Planets
Donald H. Menzel
$11.95; paper $7.95

Western Reptiles and Amphibians
Robert Stebbins
$13.50; paper $9.25

Wildflowers (Eastern)
Peterson and McKenny
$11.95; paper $7.95

Insects
Borror and White
$11.95; paper $7.95

Mexican Birds
Roger Tory Peterson
$14.75

Birds' Nests
Hal H. Harrison
$11.95

Pacific States Wildflowers
Theodore F. Niehaus
$15.50

Eastern Edible Wild Plants
Lee Peterson
$11.95

Golden Nature Guides

These 160 page books overflow with accurate full-color illustrations and interesting information which makes learing easy and enjoyable.

Birds	$1.95
Botany	$1.95
Butterflies and Moths	$1.95
Ecology	$1.95
Fishes	$1.95
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Fossils	$1.95
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Mammals	$1.95
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Pond Life	$1.95
Reptiles and Amphibians	$1.95
Rocks and Minerals	$1.95
Seashores	$1.95
Spiders	$1.95
Stars	$1.95
Weeds	$1.95
Zoology	$1.95

Books For Adults

Enjoying Nature with your Family
Michael Chinery
Interesting projects and experiments to increase your knowledge of nature using easily avialable materials. $16.75

Exploring Nature with Your Child
Dorothy Shuttlesworth
Practical field study advice on all types of flora and fauna as well as projects for the family. Numerous color photographs. Harry N. Abrams, Inc., Publishers, New York. $18.50

Art Lessons that Teach Children About Their Natural Environment
Ruth Peck
More than fifty art lesson plans designed to help make elementary school children more aware of themselves and their relationship to their environment. Parker Publishing Co., West Nyark, New York. $14.95

Canadian Wildflowers (1976)
Mary Ferguson and Richard M. Saunders
A lovely portfolio of native wildflowers. Complete botanical details and a short descriptive text are included. $19.95

Trees of North America
Brockman et al.
A field guide with color illustrations located opposite the text and range maps. $9.95; paper $4.95

Common Marsh, Underwater and Floating-leaved Plants of the U.S. and Canada (1970)
N. Hotchkiss
paper $4.45, $4.95

Common Weeds of Canada/Les mauvaises herbes communes du Canada (1976)
Gerald A. Mulligan
A compendium of Canada's most prevalent weeds, illustrated with color photographs. paper $6.95

The World You Never See: Insect Life (1976)
Theodore Rowland-Entwistle
An excellent introduction to the diversity of insect form and behavior with full color photographs throughout. $13.50

Constellations: A Consise Guide in Colour (1969)
Joseph Klepesta and Antonin Rukl
A color map of each of the 88 constellations plus information on the distance, apparent and absolute magnitudes and type of stars in each constellation. $3.95

Stars and Planets
Ian Ridpath
A beautifully illustrated, up-to-date tour of the solar system. The development of modern viewing techniques and phenomena such as pulsars, quasars and black holes are clearly explained. $7.95

Gardening with Wildlife
National Wildlife Federation
A comprehensive gardening book to show how to raise a garden, and how to create and enjoy an entire natural backyard habitat. Beautifully illustrated. National Wildlife Federation, Washington, D.C. $12.95

Annotated Checklist of the Birds of Ontario

R.D. James, P.L. McLaren, J.C. Barlow

75% of the birds known to occur in Canada have been recorded in Ontario. This book lists these species with summary information on breeding, frequency, abundance, seasonal distribution, migratory status and the subspecies found in the Province. Paper $2.50

The Audubon Society Book of Wild Birds

Les Line and Franklin Russell

Familiar and exotic birds are captured with a breathtaking fidelity to color and detail by 67 outstanding bird photographers. A richly informative text complements the 203 color photographs. If birds mean anything to you, you will never tire of looking through this glorious book. $45.00

Wildlife's Christmas Treasury

National Wildlife Federation

Includes reflections on winter, wildlife information, instructions on Christmas decorations, songs and stories. National Wildlife Federation, Washington, D.C. $9.95

Great Canadian Animal Stories

edited by Muriel Whitaker

Sixteen stories by Farley Mowat, Grey Owl, Jack London, Ernest Thompson Seton, Charles G.D. Roberts and others are in this collection for animal lovers. $12.95

Wildlife's Holiday Album

National Wildlife Federation

An Anthology of nature lore and holiday customs throughout the year. Filled with color photographs. National Wildlife Federation, Washington, D.C. $9.95

Experiences with Plants for Young Children

Frank C. Gale and Clarice W. Gale

Science experiences designed for Teachers and parents to use with four-and-five-year-olds. Pacific Books, Publishers, Palo Alto, California.

Nature Activities for Early Childhood

Janet Nickelsburg

Designed to help parents and teachers provide young children with experiences in observing nature so as to stimulate them to adventure into the unknown. Addison-Wesley Publishing Co., Don Mills, Canada. $7.50

Dyes from Lichens and Plants: A Canadian Dyer's Guide

Judy Waldner McGrath

The fundamental principles which underlie the art of natural dyeing are brought together in one book to help us rediscover the subtle beauty of the colors stored in the lichens and plants around us. $14.95

Field Guide to Edible Wild Plants

Bradford Angier

A quick, all-in-color identifier of more than 100 edible wild foods growing free in the U.S. and Canada. Stackpole Books, Harrisburg, P.A. $4.95

Photography for the Joy of It

Freeman Patterson; colour photographs by the author

As a well-know photographer and photography teacher, Freeman Patterson has developed a reputation in this country for his ability to awaken in photographers a new sense of enjoyment and direction in their craft. Now he has written a book to help both novice and experienced photographers to use photos to communicate ideas and emotions. Paper $9.95

Field Photography: Beginning and Advanced Techniques

Alfred A. Blaker

One of the best books on the subject. $23.95

Children's Books

Outdoor Things to Do

William Hillcourt

Year-round nature fun for girls and boys. Western Publishing Co., Inc. Racine, Wisconsin. $8.10

Animals In Your Neighbourhood

Seymour Simon

Exploring the natural world in your own neighbourhood. About pigeons, sparrows, ants, moths, butterflies, spiders, earthworms and squirrels. Ages 7-9. Walker and Company, New York. $5.50

Days In the Woods

A. Harris Stone and Dorian Brooks

An introduction to the plants, animals and sounds one might encounter on a walk through the woods. Prentice-Hall, Englewood Cliffs, N.J.

Holiday in the Woods

Anne Francis

A young boy spends his summer holiday with relatives at their cottage in the Laurentians and discovers many fascinating things about animals, their habits and the sounds they make. One of the best nature adventure stories available. For readers 8-12. Clarke, Irvin & Co. Ltd., Toronto. $6.95

Where Does the Garbage Go?

Paul Showers

A Let's-Read-and-Find-Out Science Book for young children. Explains what happens to our garbage once it has been dumped -- where it goes and how it can be used. Thomas Y. Crowell Co., N.Y. $4.55

Something to Make, Something to Think About

Martha Olson Condit

An unusual project book for youngsters. Instructions are included for such things as magic forests, waterscopes, sun clocks, flower faces and bird spinners. Four Winds Press, New York. $4.95

Fun With Naturecraft

Avery Nagle and Joseph Leeming

Nuts, feathers, pine needles, seeds and many other things easily collected near the home can be turned into beautiful, practical, low-cost gifts, games and toys. J.B. Lippincott Company, N.Y. $6.95

American Wildflowers Coloring Book
P.E. Kennedy
Paper $1.95

Audubon's Birds of America Coloring Book
P.E. Kennedy
Paper $1.95

Canada's Monsters (10 years and up)
Betty Sanders Garner
A colourfully illustrated account of such strange creatures as the sasquatch and Ogopogo. Paper $4.95

Common Weeds Coloring Book
Stefen Bernath
Paper $1.95

Foxtails, Ferns and Fish Scales: A Handbook of Art and Nature Projects (10 years and up)
Ada Graham
$9.85

Garden Flowers Coloring Book
Stephen Bernath
paper $1.95

Growing a Green Thumb (8 years and up)
Loraine Surcouf
An excellent Canadian book on starting a garden -- digging, planting, watering, insect enemies, birds, toads and all the other activities that children can do in and with a garden. Paper $3.95

Herbs Coloring Book
Stephen Bernath
Paper $1.95

The Long Ago Lake: A Child's Book of Nature Lore and Crafts (10 years and up)
Maine Wilkins
Making things from the offerings of woods and fields with the emphasis on how to be outdoors responsibly. $11.50; paper $6.95

Look, Mom, It's Growing (5 - 12 years)
Ed Fink
Easy projects to delight and instruct children in the basics of gardening.
Paper $3.95

Lost in the Barrens (8 - 12 years)
Farley Mowat
paper $2.95

Owls in the Family (8 - 12 years)
Farley Mowat
The humorous tale of two owls who turned an entire household upside down.
$7.50; paper $1.95

A Spider Might (8 years and up)

Tom Walther

A book about the amazing things a spider might do. For anyone who only thinks of spiders as creepy or scary, here is a whole new way to look at them. $9.95; paper $5.95

The View from the Oak: The Private Worlds of Other Creatures (10 years and up)

Judith and Herbert Kohl

This book explores the ways in which living creatures experience space, sense time and communicate with others of their kind. Paper $5.95

The Wind in the Willows (5 years and up)

Kenneth Grahame, illustrated by Ernest H. Shepard

The classic tale of Mole who walks away from his spring-cleaning into great adventures with Rat, Toad and Badger. Paper $4.95

Books by Thorton W. Burgess (3 years up)

The Adventures of:

Bob White	$1.79	Ol' Mistah Buzzard	$1.79
Bobby Coon	$1.79	Old Man Coyote	$1.79
Buster Bear	$1.79	Old Man Toad	$1.79
Chatterer the Red Squirrel	$1.79	Paddy the Beaver	$1.79
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Mr. Mocker	$1.79	Unc' Billy Possum	$1.79

Let's-Read-and-Find-Out Series (4 - 6 years)

Excellent books on nature for beginning readers. Each book is well illustrated with appealing black-and-white and color drawings.

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Paperback Editions

Bees and Beelines	$2.50	Oxygen Keeps You Alive	$2.50
Birds at Night	$2.50	Spider Silk	$2.50
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The Ways of Plants Series (5 - 8 years)
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Each book in this stunningly illustrated series introduces a different aspect of plant life. $8.95 each.

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Petals Yellow and Petals Red
Mysteries in the Garden
Swords and Daggers
Prize Performance
And a Sunflower Grew
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Animal Houses
Animal Disguises
No Accounting for Tastes
Now That Days Are Colder
Tail Twisters
Sleepy Heads
Going Places
Filling the Bill
"You Don't Look Like Your Mother",
Said the Robin to the Fawn
Animal Jackets

Children's Magazines

Owl, The Canadian Outdoor and Wildlife Magazine for Children, the Young Naturalist Foundation, Toronto. 75¢ per copy.

Chickadee, a junior edition of Owl. For children 4-8. The Young Naturalist Foundation, Toronto.

Ranger Rick's Nature Magazine -- published monthly -- Natural Wildlife Federation, Vienna, VA. -- available only to members of Ranger Rick's Nature Clubs. Membership $8.00

METRIC CONVERSION TABLES

Centimetres to Inches and Feet (approx.)

cm	Inches	cm*	Feet	Inches
0.1	0.03	10		4
0.2	0.07	20		8
0.3	0.11	30		11
0.4	0.15	40	1	4
0.5	0.19	50	1	8
0.6	0.23	60	2	0
0.7	0.27	70	2	3
0.8	0.31	80	2	8
0.9	0.35	90	3	0
1.0	0.39	100	3	4

		m*	Feet	Inches
1.0	0.394	1	3	4
2.0	0.787	2	6	7
3.0	1.181	3	9	11
4.0	1.575	4	13	2
5.0	1.969	5	16	5
6.0	2.362	6	19	8
7.0	2.756	7	23	0
8.0	3.150	8	26	3
9.0	3.543	9	29	6
10.0	3.937	10	32	10

*To read table:
(e.g.) 70 cm = 2 ft. 3 in.

Note:

1 centimetre (cm) = 0.393 inch (in.)
100 cm = 1 metre (m)
12 inches (in.) = 1 foot (ft.)

Inches and Feet to Centimetres and Metres (approx.)

Inches	cm
1	2.54
2	5.08
3	7.62
4	10.16
5	12.70
6	15.24
7	17.78
8	20.32
9	22.86
10	25.40
11	27.94
12	30.48

Feet	m
10	3.04
20	6.09
30	9.14
40	12.19
50	15.24
60	18.28
70	21.33
80	24.38
90	27.43
100	30.48

Feet	m
1	0.304
2	0.609
3	0.914
4	1.219
5	1.524
6	1.828
7	2.133
8	2.438
9	2.743
10	3.048

100		30.48
200		60.96
300		91.44
400		121.92
500		152.40
600		182.88
700		213.36
800		243.84
900		274.32
1000		304.80

100 centimetres (cm)	=	1 metre (m)
12 inches (in.)	=	1 foot (ft.)
1 inch	=	2.54 cm exactly
1 foot	=	0.3048 m exactly


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